CANADA

VERIFICATION IN ALL ITS ASPECTS

A Comprehensive Study on

Arms Control and Disarmament Verification

Pursuant to

UNGA Resolution 40/152(o)

APRIL 1986

86-06244/

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I PREFACE

On December 16, 1985, the United Nations General Assembly adopted by consensus resolution 40/152(O) entitled "VERIFICATION IN ALL ITS ASPECTS". This resolution, initiated by the Government of Canada, inter alia, called upon Member States of the UN:

> ...to communicate to the Secretary-General, not later than 15 April, 1986, their views and suggestions on verification principles, procedures and techniques to promote the inclusion of adequate verification in arms limitation and disarmament agreements, and on the role of the United Nations in the field of verification;...

The adoption of the resolution reflected the growing awareness within the world community of the importance of verification in the process of developing effective arms limitation and disarmament agreements.

The resolution also reflects the belief that all countries, not just the major powers, can make practical and thoughtful contributions on verification questions.

This study was undertaken pursuant to UNGA resolution 40/152(O) and in support of a Canadian response to the February 15, 1986 letter of the Secretary-General of the United Nations which invited the views of Members States on "VERIFICATION IN ALL ITS ASPECT".

II SIGNIFICANCE OF VERIFICATION

No single issue is likely to be of greater significance in international disarmament and arms control negotiations than verification. Particularly in conditions of suspicion and uncertainty, nations are unlikely to accede to treaties affecting their national security without adequate means of assurance that other signatories will, in fact, be living up to the terms of the agreement.

An arms control agreement is essentially a compromise in which each side bases at least part of its national security on the promises of the other contracting parties rather than on the strength of its weaponry. Consequently, reciprocal confidence that all parties will live up to their obligations is essential. Since the benefit to each participating state derives from the compliance of the other participants in the agreement, there is a natural desire for some form of external assurance that all participants are fulfilling their obligations. In simple terms, verification is the means by which such assurance is gained. Consequently, the reliability and adequacy of the verification measures associated with an arms control agreement is usually of vital importance both to the successful negotiation of the agreement and to the successful operation of the agreement once it enters into force.

The record of the 1980s to date, with regard to negotiation and conclusion of significant arms limitation agreements, is not encouraging. A number of factors have contributed to this situation. Serious concerns about possible non-compliance with existing agreements is one of these, which has led to increased demands that stringent verification provisions be included in future arms control and disarmament agreements. Not all nations, however, agree with this emphasis on verification. The most frequently heard criticisms of this emphasis on verification can be summarized as follows:

1) verification cannot be usefully considered in a general way, that is, outside of the context of a specific agreement;

2) verification is used as a pretext deliberately to impede or avoid progress in the negotiation of agreements; and

3) perfect verifiability is elusive and should not stand in the way of concluding agreements.

With respect to the first point, it is unrealistic to insist that discussion of verification can only be agreement-specific. In fact, as Chapter VI and Annex IV illustrate, there is a large number of constructive initiatives that a country might undertake outside of the context of negotiations that can contribute to the potential for the verification of specific agreements. A good example of this is the work of the Conference on Disarmament's Group of Scientific Experts, whose cooperative research into seismological techniques, in spite of the absence of a specific Comprehensive Test Ban Treaty (CTBT), has advanced considerably the global capability for monitoring a future CTBT. Research into verification, of course, is not an end in itself, but a clear understanding of the principles and process of verification would facilitate arms control and disarmament negotiation.

It is also contended that generic research into and discussion of verification is not productive. Such a view ignores the possibility of applying general procedures and techniques to specific arms limitation questions. For example, techniques developed by the International Atomic Energy Agency (IAEA) have potential application in the verification of a variety of multilateral agreements, including a convention on chemical weapons. Moreover, the basic principles of verification, such as those developed at the first United Nation's Special Session on Disarmament (UNSSOD I), have applicability to all specific arms limitation issues. Attempts to study the implications of these principles and relate them to the procedures and techniques involved in verification can be highly productive both in generating new ideas and solutions to specific problems and in overcoming obstacles in specific negotiations. For example, verification research into remote-sensing techniques can assist in developing general information-gathering techniques that improve the capability for collecting agreement-relevant data while reducing the need for physical intrusion and, therefore, reducing the likelihood that information not relevant to the verification activity in question will be collected.

The verification requirements in certain agreements may be so complex that, without substantial preconsideration of verification questions, negotiations may founder and agreements may become impossible to conclude. Therefore, it is crucial that there be attempts to address verification concerns beginning in the earliest stages of agreement consideration. Moreover, technologies and procedures for verification purposes must be continually

discussed, researched and updated if verification capabilities are to keep pace with the demand placed on them through relentless technological development and increasingly complex arms limitation agreements.

There is considerable scope for joint research among countries and for the sharing of information on verification research. Such endeavours not only serve to promote progress in arms limitation negotiations but also help build confidence between nations as they cooperate in overcoming shared problems.

As to the second criticism of verification, there is no question that there is the potential that excessive demands for verification can be used as a "smokescreen" or guise for a party which does not wish to negotiate in good faith. Similarly, there is always the possibility that countries can impede progress in arms limitation by not agreeing to legitimate demands for reasonable verification measures. The verification issue is not unique in this respect; all treaty issues (e.g. scope, nature, purpose) can be similarly used as pretexts for avoiding sincere negotiations.

The third criticism sometimes appears to carry with it the implication that the act of concluding an arms control agreement, however inadequately verified, is preferable to achieving no agreement at all. Such an attitude ignores the profoundly detrimental ramifications of an agreement that, as a result of insufficient verification, either overlooks violations or gives rise to unfounded allegations of non-compliance. Clearly, a treaty that is not being complied with can be a greater danger than no treaty whatsoever, because of the distrust and tension that are inevitable when compliance is in doubt and national security is at risk.

It must be acknowledged that perfect verifiability is not possible. The objective must be to reach agreement on verification measures which would provide all parties to an agreement with the assurance that non-compliance of a nature which would threaten their national security would be reliably detected in a timely way. However, to date, the range of verification measures needed to achieve this level of verification have been resisted by certain states.

III BACKGROUND

a) History

It has taken much of the 20th century to recognize that some limitations on sovereignty have to be accepted in order to achieve enhanced security for all states. At the Hague Conference of 1899, government representatives gathered to consider ways to curb the progressive development of armaments. Then, as now, concerns were expressed about whether all states would observe disarmament agreements and whether international inspection would be permitted to ensure the observation of obligations. Then as now, certain states replied that public opinion and the vigilance of national authorities would be adequate safeguards. Then, as now, other states did not agree that national security could rest upon such measures alone.

After the First World War, diplomatic activity, including multilateral negotiations, increased in intensity through the 1920s and early 1930s, only to end in failure. The need for assurance of compliance with prospective agreements ran up against mistrust, secrecy and, de facto, a preference for self-reliance on matters related to national security. Nevertheless, the intellectual ferment of the lengthy Preparatory Disarmament Commission (1926-31), and of the shorter World Conference for the Reduction and Limitation of Armaments (1932-34), did lead to significant explanations of and, in some cases, changes in the positions of some participants with respect to the issue of international inspection. Other political and military developments, however, prevented the refinement of thinking about the means to the desired end. It is perhaps not surprising that much of the multilateral negotiating activity in the aftermath of the Second World War has encompassed a re-statement of positions and views that had been expressed by one participant or another in the major conferences prior to that War.

Since then, verification of compliance has been a central issue in disarmament and arms limitation discussions. In the Baruch Plan of 1946, for example, verification was reflected in many of the activities and responsibilities of the proposed International Atomic Development Authority, most notably with respect to inspections. Another early example of the pivotal nature of verification was the innovative "Open Skies" proposal of President Eisenhower in 1955 which was designed to prevent surprise attack and to begin a comprehensive and effective process of inspection and disarmament. The proposals of both the

USSR and the USA during the early 1960s on General and Complete Disarmament (GCD), including the McCloy-Zorin agreed statement, recognized the need for the very extensive use of an International Control Organization to monitor compliance.

As the focus of negotiations moved away from comprehensive proposals for GCD later in the 1960s, the issue of verification continued to be a central concern. The debate about verifying a nuclear test ban highlighted this trend, receiving much attention in the late 1950s, most notably at the first meeting of seismic experts in Geneva in 1958.

The 1960s and 1970s saw tremendous strides in the development of remote sensing technologies for military intelligence and other purposes. These advances involved the use of remote sensors or, as they have come to be known, "national technical means" (NTM), to monitor events at great distances. The ability to adapt certain of these remote sensing techniques to the arms control verification process greatly facilitated the negotiation of a number of significant bilateral strategic arms limitation agreements during the 1970s.

Several multilateral treaties were achieved during these years, some of which involved innovative verification provisions (see Annex II). Others, unfortunately, lacked any meaningful verification mechanisms, a fact which would later come back to haunt the world community as controversies emerged about alleged violations for which no effective verification procedures applied.

b) First United Nations Special Session on Disarmament (UNSSOD I) (23 May - 1 July 1978)

The Final Document of the United Nations General Assembly's first Special Session on Disarmament (UNSSOD I) contained an Introduction, a Declaration, a Programme of Action and a section on international disarmament machinery, discussions and negotiations. Several paragraphs of this authoritative text have direct relevance to verification by enunciating some important general principles. While the principles embodied in these paragraphs are dealt with in detail in Chapter III, they are reproduced here in full:

> Declaration (paragraph 31): Disarmament and arms limitation agreements should provide for adequate measures of verification satisfactory to all

parties concerned in order to create the necessary confidence and ensure that they are being observed by all parties. The form and modalities of the verification to be provided for in any specific agreement depend upon and should be determined by the purposes, scope and nature of the agreement. Agreements should provide for the participation of parties directly or through the United Nations system in the verification process. Where appropriate, a combination of several methods of verification as well as other compliance procedures should be employed.

Programme of Action (paragraphs 91 and 92): In order to facilitate the conclusion and effective implementation of disarmament agreements and to create confidence, States should accept appropriate provisions for verification in such agreements.

In the context of international disarmament negotiations, the problem of verification should be further examined and adequate methods and procedures in this field be considered. Every effort should be made to develop appropriate methods and procedures which are nondiscriminatory and which do not unduly interfere with the internal affairs of other States or jeopardize their economic and social development.

c) Second United Nations Special Session on Disarmament (UNSSOD II) (7 June - 10 July 1982)

The second Special Session reaffirmed the Programme of Action of UNSSOD I. As was the case for UNSSOD I, several proposals were put forward by individual countries regarding verification. However, no new principles relating to verification were adopted by the General Assembly.

d) Bilateral Negotiations

Among the most significant arms limitation agreements are those which have been concluded bilaterally between the USA and the USSR. Both countries have expended great effort in the development of verification procedures and techniques using the most advanced technologies available. Annex I lists these bilateral arms limitation agreements as well as their relevant verification provisions. Five such agreements explicitly refer to the use of "national technical means" (NTM) for the

purposes of verification. Of these agreements only one is formally in force: The 1972 Anti-Ballistic Missile Treaty. The 1972 SALT I Interim Agreement expired in 1977, although the parties have agreed to continue to abide by its terms. As well, three other unratified agreements contain similar provisions dealing with NTM: SALT II of 1979 (Article XV), the Threshold Test Ban Treaty of 1974 (Article II) and the Peaceful Nuclear Explosions Treaty of 1976 (Article IV).

The provisions relating to NTM are identical in the ABM Treaty (Article XII) and SALT I (Article V). They read as follows:

1. For the purpose of providing assurance of compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law.

2. Each party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article.

3. Each party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with the provisions of this Treaty. This obligation shall not require changes in current construction, assembly, conversion, or overhaul practices.

The unratified SALT II agreement contains the same undertakings. "Deliberate concealment measures" are, however, defined in greater detail in Agreed Statements and Common Understandings associated with this agreement, and include measures carried out deliberately to hinder or impede verification of compliance by NTM (First Agreed Statement to Paragraph 3 of Article XV). Explicitly banned are encryption of telemetry when it impedes verification (Second Common Understanding) and the use of shelters which impede verification (Third Common Understanding).

The Threshold Test Ban Treaty (TTBT) and Peaceful Nuclear Explosions Treaty (PNET) repeat paragraphs 1 and 2 of the above-mentioned provisions relating to the use of NTM. They also include other provisions, the most notable of which is the outlining of a procedure for voluntary

on-site inspection of peaceful nuclear explosions contained in the PNE Treaty.

In addition to the use of NTM for verification, the ABM Treaty set up a Standing Consultative Commission (SCC), which (inter alia) is intended to:

a) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous;

b) provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;

c) consider questions involving unintended interference with national technical means of verification; (Article XIII(1)).

By explicit agreement the SCC was mandated to handle similar matters as they relate to other agreements [See SALT I (Article VI) and SALT II (Article XVII)]. The SCC also seems to have been used as a forum for dealing with matters relating to the unratified TTBT, the basic provisions of which, like those of SALT II, both sides have agreed to observe.

The technical systems which constitute national technical means are not identified in any of the aforementioned agreements; however, application of these means to the arms control process has been acknowledged in official statements by leaders of both the USA and USSR.[1]

The United States Arms Control and Disarmament Agency (ACDA) has provided a very comprehensive definition of NTM:

> Assets which are under national control for monitoring compliance with the provisions of an agreement. NTM include photographic reconnaissance satellites, aircraft-based systems (such as radars and optical systems), as well as sea and ground-based systems (such as radars and antennas for collecting telemetry)...[2]

While many technical systems come within the scope of "NTM", there seems to be general agreement that satellite systems form the primary NTM system. As technology develops and as satellite sensors grow in their

capabilities to monitor events on earth, the importance of satellite verification is likely to increase.

NTM, however, are not panaceas for resolving the difficulties inherent in the verification of compliance. They are circumscribed by very significant limitations. Such limitations include those relating to: a) resolution capabilities; b) environmental factors (eg. cloud coverage, amount of available light); c) satellite launch and orbital constraints; d) launch vehicle payload considerations; e) range and coverage; f) processing restrictions on massive amounts of data; g) real-time transmission of data problems; h) cost and availability of technology expertise; and i) the possibility of interference with NTM. Furthermore, many activities are only marginally susceptible to verification using long-range sensors. The superpowers have recognized the limitations of NTM and have addressed them in several ways in their agreements.

One way they have done this is through the use of cooperative measures which are negotiated or voluntary, normally non-intrusive measures used to enhance the ability to verify compliance. One example is the use of Externally Observable Differences to distinguish between different types of heavy bombers as part of the SALT II agreement. Such differences improve the ability of remote sensors to verify obligations with respect to bombers. Two other important cooperative measures are prohibitions on interference with NTM and on deliberate concealment. There are numerous other examples of such agreed measures intended to promote successful verification by NTM. Unfortunately, compliance with some of these measures has itself become controversial.

In addition to cooperative measures, the parties have introduced the concept of collateral constraints. These are measures designed to foreclose the most likely avenues of evasion. An example is the ban on production of the Soviet SS-16 ICBM (Common Understanding to Paragraph 8 of Article IV, SALT II). Because this missile appeared compatible with the launcher for the IRBM SS-20 which was not covered by SALT II, without such a ban it would have been very difficult to verify whether SS-20 launchers were equipped with SS-16 ICBMs.

Some examples of how cooperative measures and collateral constraints can be used to enhance the effectiveness of verification techniques are listed in Annex III.

Bilateral arms limitation agreements have served to highlight several lessons relating to verification which might profitably be extended to the multilateral field. These include: a) the value of using NTM in some circumstances, b) the importance of non-interference with verification methods and non-concealment, c) the use of cooperative measures and collateral constraints, and d) the utility of a consultative commission.

Among the other lessons that can be learned from the verification of existing bilateral arms limitation agreements is that a complete ban on a system is easier to verify than are numerical limitations since, in the case of a complete ban, the detection of only a single illicit weapon demonstrates a violation. The verification mechanism does not need to monitor the numbers of weapons, with all the attendant complications of such an exercise.

Qualitative restrictions, especially those which are not easily observable can also complicate verification. While cooperative measures and collateral constraints can assist in reducing such verification problems, it is likely that intrusive techniques such as inspections would be required to verify such restrictions adequately.

Several other inferences can be drawn from the bilateral experience. Primary among these, perhaps, is the importance of drafting with precision the terms of an agreement so as to avoid confusion and contradictory interpretations regarding verification evidence. It is essential to define precisely a limitation before one can hope to verify it adequately. The same drafting precision is needed with regard to verification provisions. Secondly, there is a requirement for an agreed set of procedures and rules for handling verification evidence so as to facilitate authoritative interpretations. Finally, experience has demonstrated that verification provisions alone cannot ensure compliance, and therefore, serious consideration must be given to what steps a state may pursue if a violation is detected. If non-compliance is not met with some form of commensurate response, verification efforts are not served, and the arms limitation process is defeated.

e) Multilateral Negotiations

As the arms control and disarmament negotiating process continues to mature, it is likely that the multilateral aspects will become increasingly significant.

(Annex II lists important multilateral agreements on disarmament and arms limitation as well as their relevant verification provisions.)

> The ultimate objective of the efforts of States in the disarmament process, as enunciated by UNSSOD I, is general and complete disarmament under effective international control...Progress towards this objective requires the conclusion and implementation of agreements on the cessation of the arms race and on genuine measures of disarmament, taking into account the need of States to protect their security (Final Document, paragraph 19).

Such agreements can take many forms. The Final Document acknowledges this and contains numerous references to the need to support negotiations towards bilateral, regional and multilateral agreements. Those multilateral agreements that seek to be universally applicable have a special role. "Universality of disarmament agreements helps create confidence among states" (Final Document, paragraph 40). Moreover, universality is consistent with the ultimate objective of general and complete disarmament.

While there is notable variation among the verification provisions of multilateral agreements dealing with arms limitations, there are also certain common themes. For example, there have been several multilateral attempts to break down the verification process into two main components:

1) fact-finding (objective gathering of data), and
2) interpretation (on the basis of the collected data).

By separating these distinct verification activities, there is less likelihood of compromising the objectivity of fact-finding with the subjectivity of decision-making. In the case of the 1977 Environmental Modification (ENMOD) Convention, the former task is given to a consultative committee of experts or a specialized agency of the UN, while the latter is in the hands of the Security Council.

Most multilateral agreements provide for some form of international consultative procedure to address compliance questions, though the actual form of such procedures varies greatly. Some agreements explicitly

provide for the use of the UN or its agencies as a forum for such consultations. Clearly such consultative provisions have become necessary part of any multilateral agreement. It is questionable, however, especially in view of recent controversies over compliance, whether such provisions alone can provide adequate assurance of compliance.

Some states have suggested the need for a general International Verification Organization (IVO) with responsibility for monitoring compliance with a number of prospective multilateral agreements. Such proposals have sometimes taken the form of an international body responsible for a particular type of verification technology such as satellites. Others have proposed an international verification body in the context of monitoring a specific agreement such as a chemical weapons convention.

Many questions arise with regard to such IVO proposals, especially regarding costs, legal aspects and the relative advantages of such bodies. In contrast, proposals for international bodies to verify specific agreements often look to the IAEA as a working model of such an arrangement (see Annex V). Such bodies provide a practical solution to verification questions and could perform very useful work in the monitoring of certain agreements. They could also serve as a stepping stone towards the eventual creation of a general IVO, should the international community agree on the desirability of establishing such an institution.

It is generally true that most multilateral agreements to date have dealt with weapons systems which are not the most serious security concerns. The notable exception to this is the Non-Proliferation Treaty. Several multilateral agreements seem to be characterized by the absence or weakness of their verification provisions. This situation has led to considerable controversy in recent years. In this regard reference should be made to allegations about violations of the 1925 Geneva Protocol prohibiting the use of chemical and biological weapons and of the 1972 Biological and Toxin Weapons Convention. The lack of effective verification procedures greatly complicated the handling of these allegations and served, in most cases, to defeat attempts by the UN to ascertain the facts.

f) Conclusions

Compliance questions have arisen in both the multilateral and bilateral arms limitation context. It is

clear that in many of these cases the verification provisions have proven incapable of either dispelling doubts surrounding suspicious compliance behaviour or in providing unambiguous evidence of non-compliance.

The long history of debate over compliance and related verification issues, in both bilateral and multilateral contexts, demonstrates not only their intractability but amounts to an explicit acknowledgement of the centrality of verification to the successful negotiation and effective implementation of arms control and disarmament agreements. The considerable accumulated experience with operative bilateral agreements provides many invaluable guidelines to both the technical and institutional devices available for the resolution of verification of compliance problems. Yet the record of recent disputes about compliance with existing agreements also illustrates the pitfalls.

Experience with multilateral arms control agreements is thus far much more limited. Yet multilateral arms control and disarmament agreements are likely to acquire increasing importance. This poses a considerable challenge to international statesmanship: whereas in bilateral agreements the parties are essentially self-reliant for verification purposes, multilateral agreements will require the delegation of authority for the collection and interpretation of data, much of which will be security-sensitive, and the pooling of resources for these purposes. Nevertheless, the limited experience thus far, for example, as embodied in the existence and effective activity of the IAEA, should be cause for encouragement.

IV DEFINITIONS, PRINCIPLES, PROCEDURES AND TECHNIQUES

a) Verification Defined

The process of verification has been variously defined in sessions of the Conference on Disarmament (CD) and elsewhere,[3] usually in terms which apply to a unique set of circumstances. Thus while the definition as developed for SALT II, for example, might be mutually acceptable to the USA and USSR, it might be found neither acceptable nor applicable in a multilateral scenario. To be generally acceptable, the definition must be both simple and precise and at the same time non-partisan in origin. Since there is not yet an agreed definition in the arms control community, of the term "verify", or its derivative noun "verification", we turned to a source of expertise removed from the arms control arena but recognized as an authority on the meaning of words in the English language. The sixth edition of the Concise Oxford Dictionary of Current English defines "verify" as follows:

> Establish the truth or correctness of by examination or demonstration ...

In addition to simplicity and conciseness, this definition embraces two very basic functional concepts in the verification process. The first of these is "examination". Examination implies both inspection and interpretation. This suggests that verification is more than a technical exercise. It is, in fact, very much an interpretive activity, involving both the interpretation of evidence as well as the interpretation of the meaning of the treaty itself.

The second concept is the voluntary aspect of "demonstration" which is, perhaps in some respect, analogous to the concept of "cooperative measures". "Demonstration" is likely to gain increased significance in the process of confidence-building as arms control negotiations proceed in the 1980s.

With regard to definitions, it is important to note that the concepts of verification and compliance are inextricably linked. The term compliance is descriptive of the behaviour of a party in relation to its arms limitation obligations, whereas verification is the process of determining that the behaviour of a party is consistent with those obligations. Although the verification process may be over when it is demonstrated that a party's behaviour is inconsistent with its obligations, the related and equally important political process of

managing non-compliance is just beginning. Therefore, it is appropriate to consider the important relationship between these two issues.

b) The Functions of Verification

A starting point for any discussion of verification issues should be acceptance of the proposition that verification serves functions that are essential to the long-term success of the entire arms control and disarmament process. This fact has indeed already been clearly acknowledged by the international community, most notably in the Final Document of UNSSOD I, paragraphs 31, 91, and 92.

There is thus an international consensus that adequate and appropriate verification provisions form an essential element in all arms limitation and disarmament agreements.

The functions to be performed by verification are threefold: deterrence of non-compliance, confidence-building, and treaty assessment. In the first place, by holding out a prospect of detection of non-compliance with an agreement, verification serves to protect the security of all the parties to an agreement. When adequate verification increases the risk of detection that a violator would face, the temptation to seek advantage by violating an agreement is reduced and deterrence is enhanced.

However, verification is not only intended to detect and deter non-compliance. It also seeks to demonstrate compliance. Continued evidence or demonstration of compliance with an agreement will help build confidence in the intentions of other parties. This increased trust is likely to have positive benefits for the conduct of relations between the states in question as well as for international relations generally. To put it simply, faith in good intentions alone is not a healthy basis for concluding agreements dealing with vital national security matters. Verification supplants the need for faith in the continuing good intentions of other parties by providing an objective means of determining ongoing compliance.

Finally, verification has a third role, that of clarifying uncertainty. When an ambiguous activity is detected, an effective verification system will counteract false alarms by producing clear evidence of compliance. If uncertainty continues with respect to an activity's legitimacy, it may be an indication of an inadequacy in a

treaty provision. By providing a broad range of objective, operationally relevant data, verification provisions can provide an invaluable information base for the review and assessment of a treaty's operation in practice and point the way to possible changes in the treaty and/or its manner of application.

Verification is thus, more than a matter of providing for a "police" function. Rather, what is involved is the need, on a common-sense basis, to institutionalize in the context of relations among states the same kinds of accepted rules, procedures and expectations which govern the conduct of relations among individuals in all civilized societies. Such rules and procedures do not presume bad faith or malevolent intent on the part of others; but they allow for such a possibility and provide a framework in which unjustified accusations can be authoritatively rebutted or sanctions against misconduct can be authoritatively imposed.

In this connection, it should be emphasized that the verification process does not in itself address the issue of sanctions against misbehaviour. No judicial function is involved. This touches on perhaps the ultimate, and most difficult and sensitive problem in the whole arms control and disarmament process - the political management of the consequences of demonstrated non-compliance. The role of the verification process in this context is limited to providing, in the most comprehensive and objective way, possible relevant data about behaviour. It thus can be invaluable in limiting the scope for unjustified allegations and in providing a basis for reasoned and factually-based decisions by the international community in instances where non-compliance appears to have been demonstrated.

c) Principles

A review of the Final Document of UNSSOD I reveals several principles relating to verification. These include: 1) adequacy, 2) acceptability, 3) appropriateness, 4) universality, 5) verification methods and procedures in combination, 6) nondiscrimination, 7) minimum interference, and 8) nonjeopardizing of economic and social development.

Adequacy

The necessity for adequate verification was realized by the participants of UNSSOD I as stated in para 31 of the Final Document:

> Disarmament and arms limitation agreements should provide for adequate measures of verification satisfactory to all parties concerned in order to create the necessary confidence and ensure that they are being observed by all parties.

Adequate verification is not meant to imply 100% or perfect verification. No verification system can be totally fool-proof, nor does it need to be. Even though verification can never be perfect, to be adequate it must be able to detect, beyond a reasonable doubt, a violation of an agreement which would permit a state to acquire a military capability threatening the national security of any other party. The verification system must be capable of detecting a violation early enough so that innocent parties would be able to respond appropriately to negate any advantage that a violator might gain.

The determination of what is involved with adequate verification is probably the most controversial aspect of the verification issue; indeed, it is the essence of the debate. Opinions of what is needed to verify a particular agreement can vary widely. Some of the requirements are: 1) the availability of credible information, 2) technical feasibility, 3) manpower and 4) cost. Other important factors influencing the determination of adequacy are discussed in other sections of this paper.

Verification requires credible information on compliance behaviour. In the absence of a treaty with provision for verification data, states may have different degrees of access to information about the behaviour of other states. Some states and societies are very open in the disclosure of information relating to their military and national security behaviour. Other states are less so. As a result, there may be an asymmetry in the availability of information to verify compliance. This means that, for some states, the verification provisions of an arms limitations agreement will be seen as much more important than might be true for other states. Conversely, states which benefit from the open disclosures of others, may not, therefore, have as compelling a need for rigorous verification provisions.

The adequacy of any verification system will also depend upon the effectiveness of the technologies employed for verification purposes. The scientific and technical limitations of these techniques must, therefore, be carefully examined when negotiating and designing the verification provisions of any agreement.

Many questions remain concerning the utility of NTM, and in particular satellite systems, for verification. In the view of some states it seems that NTM are viewed as capable of providing a definitive verification mechanism in any context. Such assertions must be examined critically. While NTM can provide highly useful verification techniques, they have their limitations as noted in Chapter III. Adequate verification may require employing other methods such as inspections, in addition to NTM, because of these technical limitations and because of the difficulty of verifying qualitative treaty restrictions.

The technical adequacy of a verification system also involves ensuring that any organization created to implement the system has the technical competence and capability to do so. This implies not only the appropriate resources in terms of skilled personnel, training, appropriate machinery and devices, etc. but also the acquisition and development of expertise in the area of analysis and data interpretation. Such a capability cannot be developed overnight. Consequently, there is much advantage to be gained by testing prospective verification mechanisms such as exemplified in the 1984 test of the International Seismic Data Exchange. The continuance of such exercises and research is essential. Similarly, the sharing of the applicable experience of existing verification organizations such as the IAEA is an important means of enhancing verification capabilities.

The practical requirements of manpower and cost must also be considered when designing adequate verification measures. Grandiose schemes for verification must be assessed in critical cost-benefit terms. Systems which duplicate existing national capabilities may not be essential. The use of random sampling techniques can also serve to reduce costs.

Acceptability

Verification should be mutually acceptable or as the Final Document of UNSSOD I puts it "satisfactory to all parties". It is self-evident that without such mutual acceptability, it is unlikely that parties will agree to the provisions in question.

Appropriateness

The concept of appropriateness appears in the Final Document (paras 31 and 91) of UNSSOD I which states that:

> The form and modalities of the verification to be provided for in any specific agreement depend upon and should be determined by the purposes, scope and nature of the agreement....
>
> In order to facilitate the conclusion and effective implementation of disarmament agreements and to create confidence, States should accept appropriate provisions for verification in such agreements.

This principle is related to "minimum interference". While procedures and techniques not related to the purposes, nature and scope of the agreement, are extraneous, those which are ought to be seriously considered.

Universality

> Agreements should provide for the participation of parties directly or through the United Nations system in the verification process.

This principle of universality, enunciated by UNSSOD I (Final Document, para 31) stems from the sovereign equality of each participant in a treaty. In practical terms, however, many countries have limited resources to devote to direct participation in verification activities. For example, in agreements based upon the use of NTM for verification purposes, member states without NTM are effectively barred from the verification process.

Furthermore, these states will be unable to take advantage of the consultative process for resolving compliance problems simply because they will be unaware of compliance problems when they occur. Simply put, one cannot complain of something about which one does not know.

To include direct participation of all states in every aspect of verification activity, however, could result in unworkably complex and cumbersome procedures. In addition, duplicating the capabilities already possessed by some technologically advanced states may be unnecessary and costly. It should perhaps also be noted that this principle, as enunciated in the UNSSOD I Final Document, in no way implies or requires any form of participation in a verification process by states not party to a treaty, though such a possibility is not excluded.

These various problems have been addressed in several ways in multilateral agreements. In the Non-Proliferation Treaty, for example, an international organization (the IAEA) is used to verify certain activities under control. Parties participate in verification through the IAEA's structure (see Annex V). In the Seabed Treaty, parties can request assistance in the conduct of inspection operations from other states or "through appropriate international procedures within the framework of the United Nations" [Article III(5)].

In certain instances it may be reasonable to delegate major responsibilities for verification to countries which possess significant NTM, on a collective basis and on the understanding that there would be access to information by all parties. On the other hand, increased multilateralization of verification systems in a regional arms limitation context may have distinct advantages.

Furthermore, it is possible to imagine situations wherein global agreements with their respective verification provisions could be enhanced by complementary regional or bilateral verification provisions.

Verification Methods and Procedures in Combination

As expressed in the UNSSOD I Final Document (para 31) "where appropriate, a combination of several methods of verification as well as other compliance procedures should be employed". This is another important principle. Too often verification is seen to be synonymous with the use of one method or procedure. Instead, verification should be seen as a process involving a variety of methods, procedures and techniques which operate together. Each of the elements can complement or reinforce other elements. For example, one verification method (e.g. remote-sensing) might trigger the action of another verification method (e.g. on-site inspection) to focus in a more concentrated way on some ambiguous activity. Data provided by one method, therefore, might be used to supplement or determine the accuracy of data from another.

In many instances, the most appropriate package of verification provisions might involve an incremental process by which suspicious events or complaints are dealt with in a series of appropriately escalating steps. To achieve this escalation, it is likely that different combinations of verification methods, procedures and techniques will be necessary.

Non-Discrimination

The Final Document of UNSSOD I (para 92) urges that every effort be made to develop verification methods and procedures that are "non-discriminatory". While verification provisions will apply equally to all parties to an agreement, when it comes to implementation, differences in geography, population and size of military forces, may cause a heavier monitoring or compliance burden to fall upon certain countries. As a result, some states may appear to be treated in a discriminatory manner because they must either be subject to quantitatively more verification activities or must meet greater monitoring requirements.

In addition, the scope of the arms limitation in question may entail different treatment of countries. For example, the creation of a demilitarized zone may mean that certain countries are the focus of more intense verification activities than are other countries. Another example is the Non-Proliferation Treaty under which the most stringent verification activities (i.e. on-site inspections to discourage the diversion of peaceful nuclear material to military purposes) are applied primarily to non-nuclear weapons states.

Minimum Interference

The UNSSOD I Final Document (para 92) also urges that verification methods and procedures "not unduly interfere with the internal affairs" of states.

This principle understandably has proven to be an especially sensitive one in the discussion of verification. It is an important complement to the principle of appropriateness. It registers the obligation to build into all procedures and techniques practicable safeguards against the abuse of the verification process. It should be noted, however, that a key word in the enunciation of this principle is "unduly", which amounts to an unequivocal acceptance by the international community that a degree of "interference" in internal affairs may be necessary if the verification requirement is to be met and that the fact that a particular verification activity involves such interference is not ipso facto a legitimate ground for rejecting the activity as unacceptable. At issue in all instances is the need to balance the information-gathering requirement for verification purposes against the consequences of "interference".

Thus, in the "bargain" which constitutes an arms limitation agreement an exchange is made: in return for limiting military options (one kind of interference in internal affairs) greater information about the relevant military activities of potential adversaries will be provided for verification purposes (another kind of interference in internal affairs).

Concern about the principle of non-interference arises primarily as a result of the intrusiveness involved in various verification activities. Intrusiveness can be seen to involve two aspects: physical intrusion and cognitive intrusion. The former refers to access by foreign inspectors into the territory of the party being monitored. Cognitive intrusion involves the acquisition by foreigners of sensitive military or economic information. While these two forms of intrusion are obviously highly interrelated, there are, nevertheless, some important differences.

Although physical intrusion seems invariably to arouse greater national sensitivity than some forms of cognitive intrusion (e.g. by remote sensing devices), it should not necessarily be a special source of concern. Physical intrusion, generally, can be strictly controlled by the party being monitored since physical access can usually be limited to specific sites and to the performance of certain tasks. In some cases, humans may only be indirectly involved, for example, when automatic, unattended "black boxes" are employed.

Cognitive intrusion can arise as a result of physical intrusion, such as when human inspectors are allowed access to the territory of a party. It can also arise when no physical intrusion is involved such as when surveillance satellites are used. Both types of cognitive intrusion are legitimate under conditions of "mutual acceptability" and within the framework of an agreement. In such circumstances, no unacceptable violation of national sovereignty is involved.

While the increased use of modern international verification techniques suggests that physical intrusion may be less frequently used as an aspect of verification for some types of agreements, other areas of arms limitation may continue to require significant physical intrusion in order to achieve adequate verification. Furthermore, modern verification technology may not reduce the cognitive intrusion involved in verification activities.

Non-Jeopardizing of Economic and Social Development

UNSSOD I also included a call for the development of verification methods and procedures which do not "jeopardize" the economic and social development of states (Final Document para 92).

This principle reflects a concern about the potential disclosure of sensitive commercial or economic information during verification activities. While such concerns can be legitimate, experience suggests that effective procedures can be developed to address such risks. Functioning verification organizations, notably the IAEA, have successfully addressed these concerns.

The jeopardizing of social development as a result of verification activities is a less likely outcome. Verification relates to the acquisition of information relevant to military activities. Some countries may fear that their social development could be adversely affected by the presence of foreign nationals (inspectors) on their territory or by the increased transparency of information about their defence related activities. However, it seems probable, as experience with the IAEA has demonstrated, that with proper care, such concerns can be adequately addressed.

d) Procedures and Techniques

Verification in the generic sense has seldom been discussed in relevant UN bodies dealing with arms control and disarmament. The lack of an accepted vocabulary has led to serious problems of meaning.

An excellent example of this problem is the application of the concept of "adequacy" to the process of verification. It has been taken to mean that the verification process should meet an agreed standard - that standard, however, has remained undefined. Other adjectives such as "strict", "effective", "necessary", "valid" and "most thorough" have been used in the Conference on Disarmament in the verification context. The addition of concepts such as "transparency" and "cooperative measures" to the litany of verification terminology suggests that the development of an agreed terminology is overdue.

Arms control and disarmament verification is a sophisticated equation of three variables: the level of confidence in and stringency of the verification required, the general method or approach to be adopted for verifying the agreement, and the specific techniques and procedures

to be used. Each of these variables must be understood in relation to the overall calculation of the adequacy of the verification package. The verification process, therefore, is the application of these three variables to the verification requirements in a treaty.

The following are definitions for the three broad elements of the verification process as illustrated in the accompanying three-tier table:

- o Verification Régime refers to the overall stringency and level of confidence required in a treaty. A verification régime may fall into one of five broad categories varying from a régime under which no doubt is left in determining compliance (ABSOLUTE) to one under which the lack of verification provisions permit no knowledge of other party's compliance (NO VERIFICATION).

- o Verification Method refers to the generic approach taken to verify an agreement, such as on-site inspection or remote-sensing. Although indicative, method does not define the actual technical hardware or system used to accomplish the verification task. The eight different categories of verification methods involve different levels of intrusiveness, from the most intrusive (ON-SITE INSPECTION) to the least (the use of open, unclassified sources or COLLATERAL ANALYSIS).

- o Verification System refers to the specific techniques or technical devices (such as satellites) or the procedures (such as information exchanges) employed in a method of verification.

For a detailed description of the various régimes, methods and systems involved in the verification process refer to Annex VI.

Verification Categorization

Regimes	Methods	Systems
Absolute Verification	General on-site inspection	Photo Reconnaissance Satellite
Adequate Verification	Selective on-site inspection	"Ferret" Satellite
Limited Verification	Challenge on-site inspection	Nuclear Radiation Detection Satellite
Token Verification	Control Posts/Observer/ Liaison Missions	Spacecraft Laboratory
No Verification	Remote Sensing in-situ	Seismic Sensors
	Remote Sensing–National Technical Means	Control Posts
	Complaints/Consultation	Remote Sensing Posts
	Collateral Analysis	Peace Keeping/Observer Missions
		Literature Survey
		International Information Exchange
		Et Cetera Et Cetera

V VERIFICATION: CASE STUDIES

This chapter addresses some of the questions related to verification which have emerged in three of the major arms limitation issues presently under consideration in the Conference on Disarmament (CD).

The record of consideration of the Comprehensive Test Ban issue in the CD provides the best example of the verification issue in practical terms. Nowhere is the need for, and research involved with adequate verification more apparent than in the work of the Group of Scientific Experts (GSE), a body established by the CD to consider co-operative measures to detect and identify seismic events.

The experience of the CD pertaining to the chemical weapons issue and the outer space issue have been selected specifically because of the contrast in their histories. The prohibition of chemical weapons has been before the CD and its predecessors for almost 20 years. The depth of information available in more than 350 working papers is impressive. On the other hand, the outer space issue only became a subject of concentration by an ad hoc committee in 1985. One of the main lessons to be learned from these case studies is the central role that verification occupies in discussions of these issues as well as any potential agreement that may flow from them.

a) The Comprehensive Nuclear Test Ban

There is probably no other arms control and disarmament issue which more clearly illustrates the quintessential character of verification than the Comprehensive Test Ban (CTB). Debate surrounding the verifiability of a complete ban on nuclear testing has persisted since the earliest negotiations on the issue and continues to figure prominently in argumentation supporting the reluctance of some nations to enter into CTB negotiations.

Nevertheless, the verification complexities of a CTB have from an early stage dictated a long-term general approach to seismic research that is best exemplified in the 1984 test of the International Seismic Data Exchange (ISDE). Although a specific CTB treaty (CTBT) has not yet been negotiated, it is generally accepted that an ISDE-like network would be a necessary verification requirement. To that end, research into such systems has continued over the years even in the absence of a specific agreement.

Although seismological technologies have enhanced our ability to detect seismic events, both man-made and natural, there remains considerable doubt as to whether all nuclear tests could be accurately identified (i.e. especially in the absence of on-site and in-country inspection and monitoring systems) against certain levels of background earth noise or in de-coupled situations (those occurring in underground caverns). Some of the questions which continue to be debated in the arms control and disarmament community are listed below:

1) whether there is a threshold below which underground nuclear weapons tests are undetectable or unidentifiable, and whether there is a threshold below which nuclear weapons tests are no longer militarily significant,

2) whether nuclear explosions in underground cavities (de-coupling) can be used to evade detection or identification, even with the existence of local seismic stations or inspectors, and whether this evasion technique is economically feasible,

3) the type and number of on-site inspections, and the number and location of in-country seismic stations, that would be necessary to verify a CTBT adequately.

The issue of a CTB illustrates the complexities of applying verification technologies, however advanced, to the practical requirements of a treaty. The verification demands of a CTBT are so exacting and intrusive that, in order to have confidence in its verifiability, procedures must be developed well in advance of a treaty itself. Even with general agreement on the requirement for verification by in-country stations or on-site inspection, it will be necessary to devise procedures that would make such measures acceptable as well as effective, i.e. taking into consideration numbers of inspectors, numbers of visits, location of visits, requisite monitoring equipment, numbers and location of monitoring equipment and access to monitoring equipment and sites. These and other related questions cannot be expected to be answered without considerable discussion and negotiation. Given national sensitivities to verification measures, it is unreasonable to assume that these negotiations could be any less demanding than other aspects of a treaty. It is likely that the outcome of a treaty negotiation will depend on the success of the negotiation on verification.

In spite of the absence of a specific CTB agreement, a great deal of constructive work has been undertaken by the Group of Scientific Experts (GSE) within the Conference on Disarmament since 1976 which has gone a long way towards facilitating the verification of a CTBT or any other prospective agreement relating to nuclear tests. The Group has been asked to specify inter alia the technical features of a possible international seismic data exchange system and to provide factual results and analysis of data exchange methods.

The GSE is of great importance, both because it is engaged in general verification research and because it is a source of enormous seismological and therefore, verification expertise. Proper application of this capability towards some of the verification obstacles in the way of a CTBT is an example of how verification can be most productively explored in a generic way in a multilateral setting. The results of the work of the GSE in the last decade demonstrate the credibility and utility of the long-term approach to verification problems. An expanded mandate for the GSE in the near future would further enshrine verification as an integral component in a CTB context, and could set an example for the discussion of verification on other equally complex arms limitation questions.

b) Chemical Weapons

Second only to concern about the dangers posed by nuclear weapons has been a similar concern with respect to chemical weapons. Awareness of the significant dangers posed by chemical weapons can be traced to the end of the last century; but it was the widespread use of these weapons in the First World War which provoked the revulsion that eventually led, in rather awkward steps, to the conclusion of the 1925 Geneva Protocol. That Protocol prohibits the use in war of asphyxiating, poisonous or other gases, and of bacteriological methods of warfare. Often described as a no-first-use agreement, the Protocol contains no provision for the verification of allegations of use of chemical or biological weapons.

Since the 1960s, efforts have been made in various international fora to find a formula which would build on the 1925 Geneva Protocol and provide a total, global, and verifiable prohibition of chemical weapons - that is, one that will prohibit their development, production, stockpiling and transfer, as well as provide for the destruction of existing stocks of chemical weapons and of

their dedicated production facilities. In the 1980s, allegations and confirmed reports of the use of chemical weapons, along with concerns about the possible proliferation of these weapons in the absence of a comprehensive prohibition, have highlighted the need for and urgency of successfully concluding the on-going negotiations on chemical weapons in the CD.

To put these past deliberations and current negotiations in perspective, what we have been witnessing on a smaller scale over these many years have been the kinds of problems that one could expect in trying to negotiate general and complete disarmament.

The cautious approach displayed over the years reflects the fact that the negotiators are striving to eliminate a complete category of weapon that has already been used extensively in warfare, that is still being used, and that continues to pose serious military threats. Because chemical weapons constitute a real and existing threat, discussions and negotiations related to their elimination have been detailed and protracted, emphasizing the need for effective, clear and precise verification provisions.

The difficulty has been to find a compromise that will provide the necessary degree of assurance within the bounds of an acceptable degree of intrusiveness. This problem is accentuated by the fact that there are many chemicals being produced today which have legitimate industrial, agricultural or pharmaceutical applications, but which could also be used (and some have been used) as chemical warfare agents. The same "dual-purpose" problem will exist in the future. In fact, an additional challenge facing the negotiators is that the agreement must stand the test of time in various fields of scientific and engineering endeavour in which new discoveries and new production processes are being actively pursued around the world. Thus, the agreement, and the verification provisions of the agreement, may have to be responsive to technological developments totally unforeseen today.

A great deal of effort has been expended over the years in defining terms related to a future Convention, in describing technical processes and identifying chemical substances of potential concern to a future Convention, and in considering organizational structures and procedures which will be essential to implementation of the Convention. Much ingenuity has already been shown in the search for solutions, particularly as regards the

gathering and processing of information which will be used to verify that parties are complying with the treaty. In the course of negotiations, the following information-related activities have already been identified, although all need not apply to every situation:

- the provision of data (as prescribed in the future Convention) to a central authority, often described as the International Secretariat of a Consultative Committee;

- the monitoring of certain facilities and production processes by means of instruments;

- the corroboration of data through systematic (routine, random) on-site inspections of facilities by inspectors from the International Secretariat - which activity could include, if necessary, the collection of information from and maintenance of monitoring instruments mentioned above;

- the possibility of consultation directly between States Parties on any matter which may be raised relating to the objectives or the implementation of the provisions of the Convention - which could include bilateral arrangements for inspection or the provision of further data in order to clarify ambiguous situations;

- the possibility of consultation between States Parties through a Consultative Committee to be established under the Convention, or through any other appropriate international framework including, of course, the United Nations; and

- challenge on-site inspection performed by inspectors from the International Secretariat.

These information-related activities may be applied, as agreed in the future Convention, to ensure compliance with the Convention with respect to:

- declaration of stocks of chemical weapons;

- declaration of chemical weapon production facilities;

- declaration of facilities which could be used for the production of chemical weapons;

- destruction (or diversion to permitted purposes) of stocks of chemical weapons;

- destruction (or diversion to permitted purposes) of chemical weapon production facilities;

- production of certain quantities of certain categories of chemicals for permitted purposes, (which chemicals are highly toxic and therefore of particular concern);

- non-production of chemical weapons in facilities otherwise intended to be producing chemicals for permitted purposes, or the non-diversion of "dual-purpose chemicals"; and

- non-use of chemical weapons, in the event of allegations of use.

There is much left to be done before a comprehensive, verifiable chemical weapons Convention will be concluded. However, much has already been accomplished, and it is now time to tie the threads together, particularly with regard to the verification questions.

c) Outer Space

Discussions regarding arms limitation and outer space face a major challenge in defining precisely what might be covered by an agreement. Take as one example the question of anti-satellite (ASAT) weapons. ASATs can be based in space or "pop-up" on short notice; they can be based on aircraft or the ground; they can include devices that damage a space object by impact or they can involve the use of directed energy weapons such as lasers. It is conceivable that ASATs could be camouflaged and hidden both in space and on the ground. Moreover, civilian spacecraft could conceivably be used as ASATs. Precisely defining the scope of any agreement to prevent an arms race in outer space will thus be extremely difficult and contentious. Less ambitious agreements would seem to be much more feasible.

There are several factors, peculiar to outer space, which affect verification. To begin with, the volume of space which must be monitored is enormous, ranging from low-earth orbits of perhaps 100 km in height to geosynchronous orbits (36,000 km) and perhaps beyond. Moreover, coverage probably would have to include activities on earth as well. Fortunately, relevant launch sites

for most types of space objects are few in number and most launches can be detected and to some extent monitored using existing NTM. Though vast, outer space is relatively accessible to monitoring by NTM. While ground-based sensors must still monitor space activities through the atmosphere with its attendant problems of transparency, space-based sensors are not subject to this constraint. Research that has been undertaken in Canada suggests that spacecraft observables (form, radio-electronic emissions, etc.) are highly determinative of function, and therefore, that space objects can be identified using space-based sensors.

While the growing number of space objects increases the burden on the verification system, the task does not seem to be insurmountable. In addition, although covert development of space weapons is possible, their testing is likely to be observable. Nevertheless, such a possibility could constitute a serious threat requiring intrusive verification methods to address it adequately.

A more serious problem related to outer space verification concerns the difficulty in ensuring that earth-based weapon systems with dual capability (e.g. existing ABM and SAM systems) cannot be used as a space-based weapon systems (e.g. ASAT).

The use of cooperative measures as well as collateral constraints is likely to play a key role in any verification system for an outer space arms limitation agreement. Such cooperative measures should include agreement not to interfere with NTM or to conceal activities. One possible collateral constraint might involve the designing of potentially dual purpose systems in such a way so as to reduce their effectiveness as space weapons. Additional cooperative measures such as in-space inspections or inspections of space objects before they are launched would also probably be essential for effective verification to compensate for the limitations of NTM.

The vast majority of space activities are currently conducted by only two states - the USA and the USSR. In these circumstances, it seems most likely that any new arms limitation agreements relating to outer space weapons will first be negotiated and concluded between the USA and USSR. Obviously, the verification provisions in such agreements would be a responsibility of these states. Increasingly, however, a growing number of other countries are moving into outer space, and some of their

activities are military in nature. This trend is likely to continue for the foreseeable future. It is quite possible, therefore, that bilateral agreements between the USA and USSR might be extended to multilateral participation. The inherent vulnerability of space objects and the extensive use of space for commercial and national purposes may make a multilateral approach more attractive than might otherwise appear to be the case at first glance.

Should one or more such multilateral treaty emerge, the verification mechanisms will have to reflect a multilateral character. The principles outlined in the Final Document of UNSSOD I will have an important impact in this context.

VI WHAT COUNTRIES CAN DO - CANADA'S APPROACH

In 1979, following a review of the past 25 years of the arms control and disarmament process, Canadian experts concluded that verification had become the most significant factor in international arms control and disarmament issues. Although on the surface this conclusion does not appear to be surprising, what was remarkable in the conclusions of the review were three other related findings:

1) Verification was an area where much misunderstanding existed;

2) Verification was an area where relatively little research was being undertaken; and

3) Verification was discussed, almost without exception, ad hoc and was developed to meet criteria within specific negotiations.

Although many aspects of arms control, (relating to bilateral agreements in particular) are seen to be beyond the legal authority or the technical capability of non-superpower countries, it was decided that verification research was an area where Canada might make a practical, albeit modest, contribution. It was decided, therefore, to re-direct some of the scant resources in Canada toward a programme which would serve to broaden specialist as well as public understanding of the verification issue.

a) The Canadian Verification Research Programme

The Arms Control Verification Research Programme of the Canadian Government is currently funded at $1,000,000 per annum. Its objective is to improve the verification process which is seen as indispensible to the success of efforts to reduce and eliminate arms. It is based on the conviction that useful work on verification problems can be done in advance of negotiations towards specific agreements.

The verification programme has been developed to undertake a broad spectrum of projects and studies. One of the initial requisites was to employ not only resources from within government but to coordinate and complement those resources with others from the academic and commercial sectors where this was deemed feasible. Among the most recent projects and studies conducted by the Verification Programme are the following (see also Annex IV):

- Chemical Weapons: On December 4, 1985 Canada presented to the United Nations Secretary-General a "Handbook for the Investigation of Allegations of the Use of Chemical or Biological Weapons". The Handbook is a result of a study by Canadian scientists and officials and represents a practical contribution to the investigation of allegations of noncompliance with existing agreements relating to chemical weapons.

  Prior to this submission, Canada had, on several occasions, provided the UN with reports related to allegations of chemical weapons use.

- Comprehensive Test Ban: On February 7, 1986 the Canadian government announced its decision to spend $3.2 million over three years to upgrade the Yellowknife Seismic Array as a major Canadian contribution to research into monitoring an eventual comprehensive test ban treaty (CTBT). Yellowknife, in the Canadian Northwest Territories, is recognized as a unique and sensitive location to monitoring global seismic events including underground nuclear tests. The programme to update and modernize the Yellowknife Seismic Array will enable Canada, using the best technology available, to contribute to an international system which one day may constitute an essential monitoring element of a negotiated CTBT.

  In October, 1985, a two-year research grant was awarded to the University of Toronto to examine the effectiveness of using regional seismic data, and in particular high-frequency seismic waves, to discriminate between earthquakes and underground nuclear explosions, including those conducted in decoupled situations.

- Outer Space: Canada has investigated some aspects of the technical requirements that might exist for verifying a multilateral agreement to control space weapons. Under the "PAXSAT A" study as it is called, the feasibility of the practical application of space-based civilian remote sensing techniques to verify an outer space treaty has been examined.

- Other publications: Several highly useful reference volumes compiling materials from the CD and its predecessors have already been prepared

and distributed to delegations in the CD. These volumes cover a wide range of issues including verification, chemical weapons, radiological weapons and outer space and are valuable tools intended to facilitate research and discussions on particular issues on the agenda of the CD.

b) Safeguards Development

Outside the Canadian Government's Verification Research Programme, Canada has developed an extensive programme aimed at developing and improving the verification mechanisms of the Non-Proliferation Treaty. As both a user and an exporter of nuclear power reactors and nuclear materials, Canada recognizes that the IAEA must have strong and viable techniques and the active cooperation of the member states.

In support of the objective of the IAEA to develop an improved system of safeguards suited to the Canadian CANDU reactor, Canada established the "Canadian Safeguards Research and Development Program" in 1978 which is designed to assist the Agency in the development of safeguards systems for CANDU reactors. The program has received a five-year budget of approximately $11 million and work under this auspices is already well-advanced.

VII THE FUTURE

With or without legal provisions for verification purposes, nations will strive to collect information on the military activities of other nations which are perceived as relevant to their own national security. Such behaviour has always been, and will continue to be a predictable aspect of national behaviour. Adequately verified arms control and disarmament agreements, however, provide the means whereby certain of these basic information needs can be met under conditions where interference is minimized, sovereignty is respected and distrust is largely dispelled. Similarly, it is clear that compliance with any future significant arms limitation treaty will need to be verifiable to a high degree of confidence before nations will accede to the agreement. As allegations of non-compliance have illustrated, when this high degree of confidence in compliance does not exist, both the climate and process of arms limitation is damaged. Verification, which addresses both confidence and compliance, is at the very core of this requirement.

As any particular arms control and disarmament agreement negotiation begins to generate specific arms limitation provisions, it is obvious that verification measures will need to be tailored to the purposes of the obligations that have been designed. This process of fine-tuning is a logical and crucial second step in the overall verification process. Before this point can be reached, however, there must exist an appreciation of the capability and acceptability of verifying the obligations. Such an appreciation can only be developed through an extensive and critical examination of the many complicated factors and principles in the verification question, i.e. technical capability, adequacy, balance, acceptability, appropriateness, universality, minimum interference and non-discrimination, etc. Indeed, this preconsideration of, and research into the verification issue can generate improved capabilities which, for example, can reduce the intrusiveness of certain verification measures, thereby making them more acceptable and useful in the context of agreements. This kind of potential benefit from the study of verification is a convincing argument for a long-term study of verification issues and problems.

As the arms control and disarmament process continues to mature, it is likely that the multilateral dimensions will become increasingly significant. This reflects a number of realities: the need to deal with existing or potential weapons systems for which a large

number of countries have a capacity to develop a capability (e.g. chemical and biological weapons); the increasingly recognized interest in precluding or controlling weapons deployment in certain specified environments (e.g. the Antarctic, the seabed and outer space); and the growing recognition of the desirability in principle of universal commitments to agreed arms control measures. ("Universality of disarmament agreement helps create confidence among states": UNSSOD I Final Document, paragraph 40.)

In the resolution of the more difficult problems in the verification of multilateral agreements, the experience with bilateral agreements offers limited guidance. At issue in the multilateral context are such matters as: equitable sharing of rights, responsibilities and costs, the delegation of executive and operational responsibilities in ways which make the principles of acceptability, universality and non-discrimination operationally meaningful, and the effective coordination of procedures and techniques so as to ensure that the entire verification process is adequate, appropriate and minimally intrusive. Meeting these challenges will require careful and imaginative institution-building and the creative elaboration of new international law.

At the conceptual level, a number of possible approaches can be envisioned. One possible approach, for example, might be for the parties to an agreement to delegate to a selected group of countries possessing the relevant technological and other resources, responsibility for data collection and perhaps even for data interpretation. In effect, much of the verification service would be borrowed from those having the capability to perform it. Such an approach would need to involve a most careful elaboration of agreed terms of access to information and agreed decision-making procedures for the purpose of taking action in the light of the interpreted data.

Other approaches frequently posit the notion of an International Verification Organization (IVO), an organization created and maintained specifically for the purpose of monitoring the implementation of arms control and disarmament agreements.

a) <u>The Role of the United Nations</u>

The United Nations, in accordance with the Charter, has a central role and primary responsibility in the sphere of disarmament. Accordingly, it should play a more active role in this

> field and, in order to discharge its functions effectively, the United Nations should facilitate and encourage all disarmament measures - unilateral, bilateral, regional or multilateral - and be kept duly informed through the General Assembly, or any other appropriate United Nations channel reaching all Members of the Organization, of all disarmament efforts outside its aegis without prejudice to the progress of negotiations.

As illustrated above in the quotation from the Final Document of UNSSOD I (para 114), the United Nations has both the authority and responsibility to play a "central role ... in the sphere of disarmament." In this regard, although the United Nations' record of success may appear to be unimpressive, there is no question that the United Nations has the means to play a more significant role. The ENMOD Convention of 1977 provides an interesting example of an arms control agreement for which the initial thrust came from the United Nations, followed by bilateral negotiations, which in turn developed into multilateral negotiations leading to a treaty. No better example could be cited for the complementary roles of multilateral and bilateral negotiations. Unfortunately, no multilateral arms control treaties have been concluded since the ENMOD Convention.

However, many instances can be cited of the variety of means whereby United Nations or United Nations-related forums have provided the initial impetus, or served as catalysts or been utilized for the focus and co-ordination of pressures which have eventually led to arms control, non-armament and partial disarmament agreements of considerable significance. For example, no fewer than 11 arms control and disarmament agreements to date specifically refer to the United Nations within their provisions, with most calling upon the Security Council, the Secretary General, or United Nations agencies such as the International Atomic Energy Agency (IAEA) to provide assistance towards the verification of compliance with treaty obligations[4] (see Annex VII). Even when this is not the case (and it can never be said with certainty that agreements achieved outside the United Nations owe nothing to the United Nations system), there is considerable evidence of recognition of the importance of the United Nations in the application and even interpretation of such agreements.

In the future, although the bilateral arms control and disarmament process may continue to dominate, the United Nations' system must be capable of responding

to increased demands from the international community regarding arms limitation agreements, whether unilateral, bilateral, regional, or multilateral. It must be prepared to respond to these requests in new ways and with new approaches. Some of the possible ways in which the United Nations might make itself more useful in an arms limitation context are:

1. a further strengthening of the United Nations' capacity to investigate allegations of noncompliance. For example, fact-finding initiatives by the Secretary-General can help to bridge the gap between prohibition and verification, between the legislative and enforcement roles of the United Nations,

2. further consideration by the General Assembly or the Disarmament Commission of the essential role that verification plays in the arms limitation process, and therefore, in international security. To this end, states should be made aware that, in some cases, without stringent verification measures as a means of ensuring compliance and confidence in agreements, agreements will be either unachievable or result in allegations and increased distrust,

3. consideration of means of improving the adequacy of the Security Council as a means of resolving verification and compliance difficulties,

4. research and examination of the utility of establishing an International Verification Organization (IVO) or IVO-type organization for use in future agreements, utilizing the rich body of documentation generated over the years in the Conference on Disarmament and elsewhere,

5. recognition of the capabilities of individual nations or groups of nations as sources of verification expertise which can be offered to the international community as a means of developing a verification capability for use in future multilateral agreements,

6. greater assistance, advice, technical expertise offered to negotiators in the regional arms control and disarmament process with a view to combining international mechanisms with regional measures for verification (e.g. control system of

Treaty of Tlatelolco which combines IAEA and OPANAL safeguards - see Annex V).

This final point is affirmed in the 1981 Report of the Secretary-General on the "Study on all the aspects of Regional Disarmament". Given the appropriate flexibility, the United Nations could secure a prominent role in future regional arms limitation agreements. For example, it is likely that any significant future disarmament treaty will require space-based remote-sensing verification systems as a primary verification method. Should one or more arms limitation agreements be developed in any one region, it would be both reasonable and cost-effective to develop a single space-based remote-sensing system for the verification purposes of the agreement(s). This space-based verification capability could be generated by a group of capable nations and provided for the use of the United Nations in the context of the agreement(s). In this way the international community could participate as well as benefit from an increased security and confidence in the compliance of fellow states.

In conclusion, the international community, in the course of future arms limitation discussions, may wish to consider involving the United Nations in the formation and execution of verification provisions within agreements. Where a need exists, the United Nations should be prepared to bring together adequate verification expertise wherever it occurs and encourage states to develop procedures through which this expertise can be applied in actual agreements.

FOOTNOTES

1. It is interesting to note that in his letter of submittal to the President, dated 21 June 1978, concerning the SALT II Treaty, then Secretary of State, Cyrus Vance included the following statement:

> "To verify compliance, each Party will use intelligence-gathering capabilities known as national technical means. These include highly sophisticated technical equipment such as photo-reconnaissance satellites, land-based radars, and radar and other intelligence systems based on ships and aircraft, which we use to monitor Soviet missile tests." (United States. Department of State. Bureau of Public Affairs. Selected Documents no. 12A, "SALT II Agreement, Vienna, June 18, 1979", p. 7).

In addition, President Carter, speaking on 1 October 1978 at the Kennedy Space Centre in Florida, stated:

> "Photo-reconnaissance satellites have become an important stabilizing factor in world affairs in the monitoring of arms control agreements. They make an immense contribution to the security of all nations. We shall continue to develop them." (In: Public Papers of the President of the United States: Jimmy Carter: 1978, Book II, Washington, D.C.: Government Printing Office, 1979, p. 1682).

President Reagan has also declared that:

> "...in the area of national security, our space systems have opened unique opportunities for peace by providing advanced methods of verifying strategic arms control agreements." (Remarks of the President at Edwards Air Force Base, California, upon arrival of Space Shuttle "Columbia", 4 July 1982. In: Public Papers of the Presidents of the United States: Ronald Reagan: 1982, Book II, Washington, D.C.: Government Printing Office, 1983, p.892).

General Secretary Chernenko of the Soviet Union in a press interview referred to the existence of "radio-electronic devices deployed on land, in the Pacific Ocean and in space" in terms of national technical means. (CD/510, 18 June 1984, p. 3).

2. U.S.A. Department of State, op. cit.

3. Verification is a process of gathering and analysing information, permitting a conclusion (UN Document A/AC.187/109).

   Verification is the process of assessing compliance with the provisions of arms control treaties and agreements (US Senate Sub-Committee).

   Verification is the process of determining to the extent necessary to adequately safeguard national security that the other side is complying with an agreement (Glossary, SALT II Agreement).

   Verification is the process of ascertaining that a commitment laid down in a particular agreement in the field of disarmament or arms limitation is being met. (UN Document A/AC.187/109).

4. J. Alan Beesley, "Disarmament and the United Nations at Forty", Disarmament, A Periodic Review by the United Nations, Summer 1985, pp. 33-35.

ANNEX I: Bilateral Arms Limitation Agreements and Relevant Verification Provisions

Agreement	Scope	Verification Régime	Verification Methods
Anti-Ballistic Missile (ABM) Treaty (1972) (to be reviewed at 5-year intervals - next 1987)	Limits deployment of ABM systems to national capital regions of each country plus one other area. This was later modified by a 1974 Protocol to a single site for each country.	Adequate	Remote sensing - National Technical Means
SALT I Interim Agreement on Limitation of Offensive Arms (1972) (expired but continues to be observed)	Places a freeze on aggregate numbers of fixed land-based ICBM launchers and of ballistic missile launchers on submarines	Adequate	Remote sensing - National Technical Means
Threshold Test Ban Treaty (TTBT) (1974) (not in force)	Bans underground tests of nuclear weapons with a yield of more than 150 KT	Adequate	Remote sensing - National Technical Means
Treaty on Underground Explosions for Peaceful Purposes (PNET) (1976) (not in force)	Bans underground nuclear explosions for peaceful purposes in excess of 150 KT or aggregate yield in excess of 1,500 KT	Adequate	Remote sensing - National Technical Means (seismic) Collateral analysis Possible Challenge On-Site
SALT II Agreement (1979) (not ratified but continues to be observed)	Provides for overall ceiling on strategic nuclear delivery vehicles, sub-ceiling on launchers for all MIRVs plus heavy bombers with air-launched cruise missiles over 600 km range, MIRV launchers, warheads, etc.	Adequate	Remote sensing - National Technical Means

ANNEX II: Multilateral Arms Limitation Agreements and Relevant Verification Provisions

Agreement	Scope	Verification Régime	Verification Methods
Geneva Protocol (1925)	Prohibits the use in war of asphyxiating, poisonous or other gases and of bacteriological method of warfare	None	None
Antarctic Treaty (1961)	Prohibits nuclear explosions and disposal of radioactive wastes, any measures of a military nature and the testing of any type of weapons	Absolute	General On-Site Inspection Remote Sensing using aerial observation (Article 7)
Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Underwater (1963)	Prohibits any nuclear weapon test explosion in the atmosphere, in outer space and underwater	None	None Original parties to the treaty expected to use verification by National Technical Means
Outer Space Treaty (1967)	Prohibits placing in orbit objects carrying any weapon of mass destruction, the establishment of military installations and fortifications and the testing of any type of weapon; prohibits the conduct of military manoeuvres on celestial bodies	Limited	General On-Site Inspection with respect to the Moon and celestial bodies but not earth orbit (if possible) (Article 12) Observation of the flights of space objects on a voluntary basis (Article 10)
Treaty for the Prohibition of Nuclear Weapons in Latin America (Tlatelolco) (1968)	Prohibits the testing, use, manufacture, production, acquisition, receipt, storage, installation or deployment of any nuclear weapon by any means whatsoever	Adequate	Challenge On-Site Inspection Reporting to IAEA (Articles 16 and 12)

ANNEX II: Multilateral Arms Limitation Agreements and Relevant Verification Provisions (Cont'd)

Agreement	Scope	Verification Régime	Verification Methods
Treaty on the Non-Proliferation of Nuclear Weapons (1970)	Prohibits transfer of nuclear weapons by nuclear weapon state parties and receipt, manufacture or otherwise acquisition of nuclear weapons by non-nuclear weapon state parties	Adequate	Selective/Challenge On-Site Inspection (modified) Reporting to IAEA (Article 3)
Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and the Sub-Soil Thereof (1972)	Prohibits emplacement of nuclear weapons as described in treaty title	Adequate	General On-Site Inspection Complaint/Consultation procedure (Article 3)
Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (1975)	Prohibits the development, production, stockpiling or acquisition of bacteriological and toxin weapons and provides for the destruction of existing stocks	Symbolic	Complaint/Consultation procedure (Articles 5 and 6)
Convention on the Prohibition of Military or Other Hostile Use of Environmental Modification Techniques (1977)	Prohibits engaging in military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury	Symbolic	Cooperation/Consultation procedure (Article 5)

ANNEX II: Multilateral Arms Limitation Agreements and Relevant Verification Provisions (Cont'd)

Agreement	Scope	Verification Régime	Verification Methods
Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1984)	Prohibits the threat or use of force or any hostile act on the moon and celestial bodies including orbits around them. Prohibits the use of the moon, etc. as a base for hostile acts. Nuclear weapons or other weapons of mass destruction are banned from the moon, etc., as are the establishment of military bases, installations and fortifications, the testing of weapons and the conduct of military manoeuvres	Adequate	General On-Site Inspection Cooperation/Consultation procedure (Article 15)

ANNEX III

Verification and Cooperative Measures/ Collateral Constraints

1)	non-interference:	SALT prohibition against interference with NTMs of verification of other party.
2)	anti-concealment:	SALT/ABM prohibition against deliberate concealment measures which impede verification by NTM.
3)	cooperation and consultation:	SALT/ABM provision establishing Standing Consultative Commission (SCC) to consider questions concerning compliance.
4)	anti-camouflage:	SALT I prohibition against use of shelters to cover ICBM silos.
5)	"rules-of-the-road":	Prevention of Incidents On and Over the High Seas provisions for measures to assure safety of navigation on the open seas and in the air over the open seas.
6)	code of conduct:	Prevention of Nuclear Accidents provisions for immediate notification in the event of accidental, unauthorized or unexplained incidents involving a possible detonation of a nuclear weapon.
7)	exchange of data:	Registration Convention provisions for mandatory publication of information on objects launched into outer space.
8)	reciprocal rights of visit and inspection:	Antarctic and Outer Space treaties permitting reciprocal rights of inspection.

ANNEX IV

Verification Research Programme Publications

	Date	Title	Comment
1.	1980	A Compendium of Arms Control Verification Proposals	A joint project of External Affairs and National Defence. Also tabled as CD/99.
2.	1980	A Quantitative Working Paper on the Compendium of Arms Control Verification Proposals	A joint project of External Affairs and National Defence. Also tabled as CD/127.
3.	1981	A Conceptual Working Paper on Arms Control Verification	A joint project of External Affairs and National Defence. Also table as CD/183. Together with the previous two documents, forms a "Trilogy" of internationally recognized basic reference documents on the issue of verification.
4.	1981	Compilation of Canadian Reports on Use of Chemical and Biological Weapons in Laos and Kampuchea, 1979-1981	Submitted to the UN Secretary General.
5.	1982	Study of the Possible Use of Chemical Warfare Agents in Southeast Asia	Submitted to the UN Group of Experts.
6.	1982	An Epidemiological Investigation of Alleged CW/BW Incidents in SE Asia	Submitted to the UN Group of Experts.
7.	1982	Report on Possible Use of Chemical Warfare Agents in Southeast Asia	Submitted to the UN Group of Experts
8.	1982	A Compendium of Arms Control Verification Proposals, Second Edition	A joint project of External Affairs and National Defence. Also tabled as CD/275.
9.	1983	A Quantitative Overview of the Second Edition of the Compendium of Arms Control Verification Proposals	A joint project of External Affairs and National Defence.

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	Date	Title	Comment
10.	1983	Chemical Weapons - Compendium of CD Working Papers and Final Records, 1969-1982, 3 volumes	Distributed at CD.
11.	1984	National Positions on Verification at the CD and its Predecessors	Soon to be published.
12.	1984	The Superpowers and Verification in the Committee on Disarmament	Soon to be published.
13.	1984	Radiological Weapons - Compendium of CD Working Papers and Final Records, 1970-1984	Distributed at CD.
14.	1984	The Role of Astronomical Instruments in Arms Control Verification	Soon to be published.
15.	1984	"Observations of a Canadian Ad Hoc Group of Scientists on the World Health Organization Report entitled Health Aspects of Chemical and Biological Weapons"	Document (recorded as Conference Room Paper 1) presented to the Group of Consultant Experts established pursuant to General Assembly resolution 37/98D.
16.	1985	Seismic Verification Brochure	Distributed at the UN and CD.
17.	1985	Handbook for the Investigation of Allegations of the Use of Chemical or Biological Weapons	Submitted to the UN Secretary-General, and. to the CD in 1986
18.	1985	Outer Space - Compendium of CD Working Papers and Final Records, 1962-1984	Distributed at CD.
19.	1985	Survey of International Law Relevant to Arms Control and Outer Space	Distributed at CD.
20.	1985	Compendium of Verbatim Statements on Verificaton	Distributed at CD.
21.	1986	Compendium of Arms Control Verification Proposals, Third Edition	Soon to be published.

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	Date	Title	Comment
22.	1986	Chemical Weapons - Compendium of CD Working Papers and Final Records, 1983-85	Distributed at CD.
23.	1986	Outer Space - Compendium of CD Working Papers and Final Records, 1985	Distributed at CD.

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Extra-Mural Publications Sponsored by the Verification Research Programme

	Date	Title
1.	1984	International Security and Outer Space: Proceedings of a Conference Held at McGill University on 16-17 March 1984
2.	1985	A Proxy for Trust: Views on the Verification Issue in Arms Control and Disarmament Negotiations (Edited by John O'Manique, Carleton University)
3.	1985	Arms Control and Disarmament in Outer Space: Lecture-Seminars Given at the Centre for Research of Air and Space Law, McGill University (Edited by Nicolas Mateesco Matte)
4.	1985	Highly Toxic Chemicals: Detection and Protection Methods: Proceedings of an International Symposium, September 25-27, 1985, Saskatoon, Saskatchewan (Edited by H. Bruno Schiefer)
5.	1985	An Arms Race in Outer Space: Could Treaties Prevent It?: Proceedings of the Symposium held on October 30 and November 1, 1985, McGill University (Edited by Nicolas Mateesco Matte)
6.	1986	Compliance and Confirmation: Political and Technical Problems in the Verification of Arms Control of Chemical Weapons and Outer Space (Edited by H. von Riekhoff)

ANNEX V

FUNCTIONAL ORGANIZATIONS

a) International Atomic Energy Agency (IAEA)

Created in 1957, the primary purpose of the IAEA was to facilitate the peaceful use of atomic energy by providing technical assistance to states. An additional function pertaining to the process of verification was in accordance with the statute of the IAEA:

> To establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a state, to any of that state's activities in the field of atomic energy.

Application of safeguards (a system of technical measures within the framework of international nonproliferation policy) took second place to the primary role until the entry into force of the Non-Proliferation Treaty (NPT) in 1968. The NPT requires that member nonnuclear states accept a set of safeguards on peaceful nuclear material, including periodic inspections and audits, thus discouraging their diversion to military purposes. These safeguards must be directly negotiated with, and are administered by, the IAEA.

Nuclear materials are essential for the production of nuclear weapons or other nuclear explosives, and may be used for military purposes other than nuclear weapons. Under NPT agreements, IAEA safeguards focus on verifying that no nuclear material is diverted from peaceful activities. Also, certain non-nuclear materials may be essential for producing nuclear material suitable for use in nuclear weapons or other nuclear explosives. Such materials are required to be safeguarded under certain non-NPT type agreements.

IAEA safeguard agreements define conditions under which safeguards will be applied in nuclear installations. Nuclear installations are divided into "facilities" and "other locations" for safeguards purposes. In addition, nuclear equipment may be subject to safeguards under non-NPT agreements, at the request of IAEA Member States.

Nuclear material accountancy is the first step in the IAEA safeguards framework. These accounting activities are undertaken by or on behalf of facility operators in response to requirements set by the SSAC (State Systems of Accounting for, and Control of, Nuclear Material), arising from obligations defined in agreements between the IAEA and a state. These activities and the corresponding accounting information generated are verified through independent IAEA inspection. These inspection activities, after evaluation, provide one of the means of detecting diversion and of deterring diversion by the risk of early detection. They also make it possible to determine the degree of assurance provided by the safeguards measures.

Nuclear material accountancy depends very much on procedures, methods and techniques for the sampling and measurement of nuclear matter. Physical standards are required to calibrate measurement methods and provide a basis for determining the accuracy of measurements. A good quantitative system and control programme is essential for adequate nuclear material accountancy.

Nuclear matter must be measured to determine the amounts to be accounted for, and the accounts are therefore subject to uncertainty due to measurement errors which are inherently associated with all quantitative systems. Statistical concepts and methods are used to estimate measurement errors and to determine the level of quantitative uncertainty associated with each nuclear material account; they are further used as a basis for tests of statistical and safeguards significance and to reduce inspection effort and intrusion.

Following the initial accounting procedures, the IAEA safeguards approach to any particular facility is complemented by containment and surveillance measures. The most desirable combination of these measures is that

which permits the safeguards objectives to be achieved at acceptable costs and with minimum intrusion into routine plant operations.

Information received from a state or provided by a facility (i.e. notifications, design information, various other reports and documents, and the records of nuclear material kept by facilities) is the basis upon which the IAEA builds to discharge its safeguards responsibility. In this regard, safeguards inspection is the most important procedure implemented to verify the completeness, correctness and validity of such information.

The main system used by the IAEA to carry out its verification function is the national accounting and control system of the state to which safeguards are being applied. The IAEA requires that certain minimum elements be included in the national system which provides information to the Agency. The Agency's primary role is to verify the findings of this national mechanism.

Finally, precautions against disclosure of industrial secrets take several forms under the safeguards system. First, the access given IAEA inspectors is limited. A state can exclude sensitive areas from regular inspection under the "strategic points" selection process listed in Subsidiary Agreements. Second, the IAEA becomes legally liable if any information leakage occurs for which it is responsible. Third, the IAEA applies strict internal "safeguards" within its own organization to avoid such leakage. The fact that IAEA inspectors may be accompanied by representatives of the state being inspected helps prevent undesired disclosures.

b) OPANAL

The Treaty for the Prohibition of Nuclear Weapons in Latin America (also known as the Treaty of Tlatelolco) provided for the establishment of an international organization in order to ensure compliance with the obligations of the Treaty. Known as the "Agency for the Prohibition of Nuclear Weapons in Latin America", the "Agency" or OPANAL, it was set up in September 1969 when the Treaty entered into force for eleven states. Article 7 of the Treaty says, inter alia:

2. The Agency shall be responsible for the holding of periodic or extraordinary consultations among Member States on matters relating to the purposes, measures and procedures set forth in this treaty and to the supervision of compliance with the obligations arising therefrom.

3. The Contracting Parties agree to extend to the Agency full and prompt co-operation in accordance with the provisions of this treaty, of any agreement they may conclude with the Agency and of any agreements the Agency may conclude with any other international organization or body.

With headquarters in Mexico City, the Agency established a General Conference, a Council and a Secretariat as its principal organs. The General Conference is the supreme organ of the Agency, is composed of all the Contracting Parties, and is required to hold regular sessions every two years with provision for the convening of special sessions. The Council is composed of five Members of the Agency, elected for a term of four years by the General Conference from among the Contracting Parties. The responsibilities of the Council include ensuring, through the General Secretary who is the chief administrative officer of the Agency, the proper operation of the control system in accordance with the provisions of the Treaty. The Council submits an annual report, and any special reports it deems necessary, to the General Conference. The Secretariat is headed by a General Secretary, mentioned earlier; and the General Secretary's responsibilities include ensuring the proper operation of the control system established by the Treaty, in accordance with the provisions of the Treaty.

The purpose of the control system is explained in Article 12, and expanded upon in Articles 13 through 18 of the Treaty. Article 13 refers to IAEA safeguards, a matter of some contention for certain states. Related to this connection with the IAEA is the next Article, Article 14, concerning reporting requirements. Article 15 allows for the General Secretary, with the authorization of the

Council, to request any of the Contracting Parties to provide the Agency with complementary or supplementary information regarding any event or circumstance connected with compliance with the Treaty. The General Secretary will explain his reasons for making such a request, and the Contracting Parties undertake to co-operate promptly and fully with the General Secretary who will, in turn, inform the Council and Contracting Parties of such requests and of the respective replies.

Article 16 merits particular attention in that it outlines the circumstances in which the IAEA and the Council have the power of carrying out special inspections. A Party to the Treaty, explaining its suspicions that some activity prohibited by the Treaty has been carried out or is about to be carried out, may request the Council to arrange a special inspection, which arrangement would be made immediately. The Article also includes an interesting variant related to allegations of noncompliance. A Party which has been suspected of or charged with having violated the Treaty may request the Council to arrange a special inspection, which arrangement would be made immediately. The Article specifies that costs and expenses of any special inspection arranged by the Council shall be borne by the requesting Party or Parties, although the Council may conclude on the basis of the report that the Agency should bear the costs and expenses. The Contracting Parties have agreed to grant the inspectors conducting such special inspections "full and free access to all places and all information which may be necessary for the performance of their duties and which are directly and intimately connected with the suspicion of violation of this Treaty" (Article 16, paragraph 4). Any report resulting from such special inspections will be transmitted immediately to all the Parties, and a copy shall also be sent to the Secretary-General of the United Nations for transmission to the United Nations Security Council and General Assembly, and to the Council of the Organization of American States. A special session of the General Conference may be convened for the purpose of considering the report resulting from a special inspection.

Articles 17 and 18 deal respectively with the use of nuclear energy for peaceful purposes and with explosions of nuclear devices for peaceful purposes and, in the latter instance, outlines certain notification, information and observation provisions.

Sources:

(1) Stockholm International Peace Research Institute. SIPRI Yearbook of World Armaments and Disarmament 1969/70. Stockholm: Almqvist and Wiksell.

(2) Stockholm International Peace Research Institute. World Armaments and Disarmament: SIPRI Yearbook 1972. Stockholm: Almqvist and Wiksell.

c) Armaments Control Agency (ACA)

The Armaments Control Agency (ACA) of the Western European Union (WEU), established by the revised Brussels Treaty of 23 October 1954, has inter alia certain responsibilities for the monitoring of the non-production of chemical weapons. As explained in CD/37, a document tabled by the Federal Republic of Germany in the Committee on Disarmament on 12 July 1979, ACA administers "controls" to ensure that undertakings are being observed. These controls consist of the evaluation of written information, supplied upon request, of visits and on-site inspections. The following excerpts from CD/37 are particularly relevant to this paper:

> The initiative for on-site inspections lies with the Armaments Control Agency of the WEU. The director of the agency appoints two to four officials of different nationality, one of them a national of the country in which the inspection is to be carried out. A representative of the competent national authority assists the agency in the execution of its controls.
>
> During such controls the representatives of the agency enquire about the organization, operation and production programme of the plant.

The subsequent visit to the production plant covers only those departments dealing with the decisive phase of the chemical reaction. The inspectors are shown built-in measuring instruments so that they can verify the quantities of the pre-products employed in the production of a substance and the final output. If further clarification is required, the findings are compared with the factory's records or books.

The inspectors pay special attention to the factory's safety precautions. These are always clearly visible, cannot be concealed and together with the lack of special equipment and installations, provide the clearest possible indication that no chemical warfare agents are being produced in the plant.

In special cases sampling as a means of control is useful and effective for identifying specific substances and determining whether they are prohibited warfare agents. The high degree of toxicity of most of these substances poses the problem of liability in the case of accidents or damage caused or suffered by inspectors.

The inspection is carried out in stages in order to avoid, as far as possible, any interference with the civilian sector. As soon as the inspectors are satisfied that the non-production pledge is being kept, the inspection must cease. If the visit to the production plant, including the inspection of special safety precautions (first control measure), is not deemed to be sufficient, the control may be extended to the employment of initial and intermediate products in the controllable stage (second control measure). If there is still no certainty that chemical weapons are not being produced, the factory's records may be checked against the instrument readings (third control measure). Samples may be taken as the fourth and last measure.

After each on-site inspection the inspectors report orally to the director of the agency. They also prepare a written classified report which remains in the agency's files. It may not be brought to the notice of any person outside the agency. Neither the factory concerned nor the competent national authority is consulted in the preparation of the report.

The representative of the national authority who has taken part in the inspection also prepares a report so that the authority concerned may have its own documents available in the event of recurrent inspections. This report is transmitted to the management of the factory concerned.

The staff of the Armaments Control Agency are international officials. They must in no circumstances whatever reveal to third parties information obtained as the result of their official tasks. Special protection is accorded to industrial, economic, commercial and scientific information, whether classified or not.

The Armaments Control Agency submits annual reports to the Council of the WEU. These reports contain the number of controls, the names of the companies concerned, and the results, stating such difficulties or problems that may have occurred, without however going into detail.

It is true that the ACA inspection actually takes place in the context of a non-adversarial relationship. Nevertheless, one may conclude that it is possible for on-site inspections to prove, without disclosing any classified information on the production process, that chemical warfare agents are not being produced. Furthermore, the Federal Republic of Germany has stated that the experience gained from ACA/WEU controls "demonstrates that the practices outlined... could be useful in establishing effective and economically unharmful verification of a world-wide ban on the manufacture of chemical weapons".

ANNEX VI

Categorization

a) Verification Régimes

The degree of verification required in a given situation is dependent upon political will and judgment, and influenced by capability. Because of the subjective nature of these criteria it is difficult to quantify verification régimes. Nevertheless, it is possible to determine five distinct verification régimes:

- Absolute Verification: A régime under which no doubt is left in determining treaty compliance. In practical terms, however, the achievement of 100% verification is unlikely. Under this régime, all verification methods could be employed.

  Example: The Antarctic Treaty (signed 1 December 1959) provides for a theoretically absolute level of verification. It says in part: "Each observer designated ... shall have complete freedom of access at any time to any or all areas of Antarctica" (Article 7).

- Adequate Verification: The régime most frequently referred to. It is the subject of the greatest degree of debate because of its heavy dependence on political judgment and on the process of determining essential security requirements.

  Example: SALT II of 16 June 1979 is a treaty that illustrates the subjectivity of this régime in that its verifiability was described as adequate by some and inadequate by others.

- Limited Verification: In this régime, verification has limitations created by the inadequacy of technology available to contracting parties.

  Example: Although difficult to select an example in existing treaties, the problem of technical limitations has arisen in the negotiations concerning a possible comprehensive test ban. The

apparent inability to detect and identify subkiloton nuclear tests at long distances by seismic sensors is an indication of an area in which technology seems inadequate at the moment for verification of a proposed arms limitation agreement.

- o Symbolic Verification: A régime in which the verification capability is known in advance to be inadequate because of, for example, lack of technology. Nevertheless, the contracting parties consider that the nature of the treaty is such as to override the inadequacy of verification.

  Example: The Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) or Toxin Weapons and on their Destruction (signed 10 April 1972) provides for verification through a complaints and consultation procedure. Recent allegations of non-compliance with the terms of the Biological Weapons Convention have illustrated the inadequacy of its symbolic verification provisions.

- o No Verification: A régime in which the treaty or agreement is signed with no provision for verification.

  Example: The 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases and of Bacteriological Methods of Warfare contains no provisions for verification. This fact has resulted in serious difficulties in dealing with recent allegations of the use of chemical weapons.

b) Verification Methods

To meet the requirements of the various verification régimes, eight basic methods or procedures have been defined. These methods differ in the degree of intrusiveness and in the degree of application of advanced technology.

o General On-Site Inspection: General on-site inspection involves unrestricted access to the physical objects and related facilities that are subject to control under the terms of specific agreements. The relevant agreements could conceivably range in scope from general and complete disarmament to control of specific weapons or research related to those specific weapons. Like other verification methods, the purpose of general on-site inspection is to preclude the possibility of clandestine violations of an agreement. The degree of assurance thought to be attainable using this method varies. Some proponents consider general on-site inspection to be capable of uncovering all possible violations; others hold that it only increases the likelihood of discovery, and thereby improves the deterrent value of the verification system.

Example: The Treaty on Prohibition of the Emplacement of Nuclear Weapons or Other Weapons of Mass Destruction on the Sea Bed or Ocean Floor (signed 11 February 1971) can be seen as an agreement which theoretically permits general on-site inspection. The object of the Treaty is to prohibit the emplacement on the sea floor of nuclear weapons, other weapons of mass destruction and their related launching facilities (Article 1). The Treaty makes parties "free to observe activities of other states on the sea bed" provided that this observation does not interfere with such activities or otherwise infringe upon existing rights under international law (Article 3(1)). Should such observation still leave doubts unresolved, parties are authorized to consult and cooperate with a view to removing those doubts (Article 3(2)).

o Selective On-Site Inspection: Selective on-site inspection involves a greater degree of restriction with regard to rights of access than does general on-site inspection. Most frequently,

such restriction permits entry by inspectors only for the limited purpose of monitoring compliance with agreements concerning specific weapons systems and related facilities. From this central restriction flow certain others. Access might be allowed only to a particular geographic location, such as the site of a peaceful nuclear explosion (PNE) (as provided in the Peaceful Nuclear Explosions Treaty) or that of a facility for the destruction of chemical weapons (as put forward in a number of proposals). Second, limitations could be placed on the activities which the inspectors may undertake at the place of inspection, and on the information which they may acquire there. In the case of a chemical weapons treaty, some sensitivity might be shown to analyzing the nature of a chemical agent which is in the process of being destroyed, on the pretext that sensitive information might be disclosed. Third, inspectors may also be limited as to the persons they may contact and the questions they may ask. Clearly, the distinction between selective and general on-site inspection, while significant, is more one of degree. There will definitely be a boundary area between the two categories where the distinction becomes blurred.

Example: In the Treaty on the Non-Proliferation of Nuclear Weapons (signed 1 July 1968) non-nuclear-weapon states agree not to receive nuclear weapons nor to develop or manufacture them (Article 2). To verify this commitment, non-nuclear weapon states undertake to conclude safeguards agreements with the International Atomic Energy Agency (IAEA) in which selective on-site inspection by IAEA inspectors is the primary verification method.

o Challenge On-Site Inspection: This method is a derivative of the first two methods. A challenge is normally initiated by one of the contracting parties and may or may not permit the right of refusal.

Example: A version of this method, monitored by the Arms Control Agency (ACA), has been in operation in Europe since 1954 with respect to chemical weapons production. It is one of the most effective and yet most intrusive methods of verification.

o Control Posts/Observer/Liaison Missions: A control post is essentially the focal point for an inspection team. An observer mission is a variation of this type of verification method. (Peace-keeping forces could be considered a further variant whose main purpose, by definition, is more than the verification of an arms limitation agreement.) The most common proposal is to have control posts at such locations as transportation centres, airfields, railway stations, main-road junctions and ports, to monitor military traffic. Such monitoring should provide warning of impending aggression by detecting any unusual flow or concentration of military power or weapons production.

One significant advantage of the control post in terms of general applicability is that it obtains information by direct observation, and therefore does not necessarily require high technology sensors. It does, however, require secure communication to an information centre so that the information collected can be properly evaluated.

Example: There are many examples of the control-post/observer mission method of verification, ranging from the United Nations Truce Supervisory Organization (1948-81) in the Middle East to the International Commission for Supervision and Control in Indo-China which operated under the 1954 Geneva Accords.

o Remote Sensing in Situ: In this method, unmanned stations with measuring instrumentation ("black boxes") can be located at a site within national borders.

Example: It has been suggested that the verification of a ban on underground nuclear tests would be facilitated by the location of unmanned seismic stations in the territory of the countries being monitored. These stations would be the property of and would provide data for designated international agencies or states other than those where they would be located. In essence, such "black boxes" would provide an extension of NTM.

o Remote Sensing - National Technical Means: The term "national technical means" (NTM) applies mainly to the two superpowers and was referred to but not defined in the SALT agreements. Consequently, the USA and the USSR may consider different types of monitoring and collection systems to constitute NTM. NTM (photoreconnaissance satellites and other such technical data collection systems) make up the principal but not the only means of monitoring the SALT agreements.

Example: While the USA and the USSR are the two major operators of NTM, at UNSSOD I France proposed the creation of an International Satellite Monitoring Agency (ISMA). The proposal envisaged many of the characteristics of NTM being applied internationally.

o Complaints/Consultation: This method involves an agreement by parties to a treaty to receive complaints and to consult as a result.

Example: The verification method proposed in the Biological Weapons Convention involves a complaint and consultative procedure.

o Collateral Analysis: This method involves perusal of the world press, scientific reports and other pertinent material that is openly available. It must be recognized that an asymmetry exists in the availability of the collateral information between different types of societies.

c) Verification Systems

Within each verification method, a number of systems have been developed by individual nations and groups of nations. These systems can be either of a technical or non-technical nature. For the most part, the systems of verification now in existence have been developed by the USA and USSR, or on behalf of their respective alliances. Since verification in the national territory of the other has so far been difficult to achieve, much of the research and development of verification systems has been directed toward remote sensing.

There are hundreds of specific verification systems, ranging from the technologically complex to the relatively simple (for example, binoculars at a distance could be viewed as a simple, remote system).

The use of long-range sensors to monitor activities within a state from outside its borders has been a positive development in the field of verifying arms control agreements. The advent of this technology has reduced to a considerable degree the significance of problems arising from the physical intrusiveness of many verification activities. The use of such sensors in this role has now apparently become internationally acceptable in terms of the superpowers' strategic balance. An arms control agreement which relies on remote sensors for verification might well include a clause prohibiting a country from interfering with the sensors monitoring the agreement.

Since virtually all remote sensors are deployed by the USA and USSR, there could be some difficulty in relying on them to monitor a multilateral agreement, unless the agreement includes some arrangement for making the information collected by the superpowers available to other signatories, for example, through an international agency. The creation of such an agency has been the subject of proposals within both the Conference on Disarmament and its predecessors for many years.

Remote Sensing Systems

Sensing systems can be termed "remote" in three ways. First, the sensor may be distant from the object it is intended to monitor, while being in the same location as personnel operating it. Fixed-site radars or seismic stations are examples of such systems. Second, the sensor may be distant from both the object to be monitored and from the personnel controlling the sensor. An observation satellite is an example. Finally, a sensor may operate in relative close proximity to the object to be observed, while being distant from its controllers. The RECOVER system developed by the IAEA is the best example of this form of remote sensing. Examples of these three remote sensing systems are more fully outlined below:

1. Seismic Sensors: Long-range seismic systems monitor surface and below-ground-level shock waves. Most of the events producing major earth shocks are natural (for example, earthquakes) and the only man-made events producing comparable shocks are large explosions of the size produced by nuclear weapons. Consequently, verification proposals employing long-range seismic sensors have invariably been confined to detecting underground nuclear explosions.

   There are four main requirements for a seismic monitoring system: (i) to detect a seismic "event"; (ii) to locate it; (iii) to identify whether it represents a natural event or a nuclear explosion; and (iv) to measure the strength of the phenomenon. Because of limitations on equipment sensitivity, there is a level below which a seismic event becomes undetectable. Location of an event usually demands detection at two or more separate locations (i.e. a detection network) and identification depends on the shock-wave pattern or "signature" of the event.

The magnitude of the shock produced by a nuclear explosion varies according to its location and the type of earth or rock in which the device is detonated. There is some controversy over the minimum size of nuclear detonation which can be detected and identified and also over how far it is possible to disguise its signature.

Many countries possess seismic detection stations for earthquake monitoring which are capable of monitoring seismic events from long distances. There have also been international seismic data exchanges held under the auspices of the Conference on Disarmament which have demonstrated the utility in monitoring underground explosions.

2. Satellites: The principal agent for remote sensing is the surveillance satellite; up to now its use in verification has been a part of the National Technical Means of the superpowers. The following three satellite systems have direct relevance to arms control verification.

Photo-reconnaissance satellite. There are two main photo-reconnaissance systems: "area surveillance" and "close look". The former involves the use of a wide-angle, relatively lowresolution camera which is employed to cover large areas and note discrepancies that may need further examination before they can be identified. "Close-look" satellites are directed to the identified areas of interest in order to collect more detailed information. Greater detail (with consequent limited area coverage) can be obtained by a combination of lower orbit, longer focal length or improved resolution. The International Satellite Monitoring Agency as defined in the French proposal would apparently include a "close-look" capability. It is possible, as well, to have specialized sensors for different purposes, for example, for maritime observation.

"Electronic reconnaissance" satellite. The so-called "ER" satellites monitor electronic radiation, including radar signals and radio communication. They comprise the electronic equivalent of both "area surveillance" and "close-look" types.

Early-warning satellite. The primary mission of these satellites is to detect the launching of ballistic missiles. To do this, they employ infrared sensors and TV cameras, and are usually placed in geo-stationary orbits. Newer versions of these satellites also incorporate nuclear radiation sensors.

3. Unmanned Remote Sensing Systems: The RECOVER system developed by the IAEA involves on-site containment and surveillance measures, including tamper-proof locks and television. Monitoring units are attached to these devices, which transmit data to IAEA headquarters in Vienna on a regular basis.

Information Exchange

The exchange of information as a means of verification is potentially one of the most effective and yet least physically intrusive verification systems. The Peaceful Nuclear Explosions Treaty (PNET) provides for a detailed exchange of information relating to the purpose, location and environment of any planned peaceful nuclear explosion, as well as more elaborate information on planned explosions in excess of certain yields (Articles II-VI, Protocol to PNET).

ANNEX VII

Specific References to the UN in Arms Control and Disarmament Agreements

(emphasis added to verification-related references)

(1) Antarctic Treaty: signed at Washington, December 1, 1959, entered into force June 23, 1961.

Article III, para 2, encouraging the establishment of co-operative working relations with relevant specialized agencies of the UN;

Article X, urging appropriate efforts consistent with the Charter of the UN;

Article XI, para 2, providing for references of certain disputes to the International Court of Justice;

Article XIII, para 1, permitting accession by any State which is a member of the UN, and para 6 providing for registration of the Treaty pursuant to Article 102 of the UN Charter.

(2) Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water: signed at Moscow on August 5, 1963, entered into force October 10, 1963.

Preamble two, proclaiming the objectives of general and complete disarmament in accordance with the objectives of the UN Charter;

Article III, para 6, providing for registration of the Treaty pursuant to Article 102 of the Charter.

(3) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies: signed at Washington, London and Moscow on June 27, 1967; entered into force October 10, 1967.

Preambles six, seven, eight and nine recalling a series of UN resolutions, in particular the Declaration of Legal Principles as well as the Purposes and Principles of the Charter;

Article III, providing that activities be conducted in accordance with international law, including the UN Charter;

Article V, providing for notification to the UN Secretary-General of phenomena dangerous to astronauts;

Article XI, providing for informing the Secretary-General of the UN of certain activities;

Article XIV, para 6, providing for registration of the Treaty pursuant to Article 102 of the Charter of the UN.

(4) Treaty for the Prohibition of Nuclear Weapons in Latin America: signed at Mexico City on February 14, 1967; entered into force April 22, 1968.

(a) Treaty:

Preambles two, three, five and six, recalling relevant UN resolutions and the principles of the UN Charter and re-affirming the principles and purposes of the Charter;

Article 13, requiring that Parties negotiate safeguards agreements with the IAEA;

Article 14, providing for semi-annual reports to the IAEA;

Article 16, conferring inspection powers on the IAEA and providing for reports on prohibited activities through the Secretary-General of the UN to the Security Council and the General Assembly;

Article 18, providing for notification of peaceful explosions to the IAEA and for IAEA observation;

Article 19, providing for agreements between the Agency set up under the Treaty and the IAEA;

Article 20, providing for reports of noncompliance through the UN Secretary-General to the Security Council and the General Assembly;

Article 21, providing for safeguarding the non-impairment of obligations under the UN Charter;

Article 24, providing for references of disputes to the International Court of Justice;

Article 28, providing for Safeguards agreements with the IAEA as a condition for entry into force;

Article 30, providing for notification of denunciation to the Secretary General of the UN for the information of the Security Council and the General Assembly;

(b) Additional Protocol I

Preamble one, affirming that the Treaty negotiated and signed in accordance with a UN resolution represents an important step towards ensuring non-proliferation of nuclear weapons;

(c) Additional Protocol II

Preamble one, affirming that the Treaty negotiated and signed in accordance with a UN resolution represents an important step towards ensuring non-proliferation of nuclear weapons.

(5) Treaty on the Non-Proliferation of Nuclear Weapons: signed at Washington, London and Moscow on July 1, 1968, entered into force March 5, 1970.

Preambles three, four and twelve, referring to UN resolutions on non-proliferation and on facilitating the application of safeguards of the IAEA and to the obligations under the UN Charter, including refraining from the use of force against the territorial integrity or political independence of any State;

Article III, providing for the negotiation and conclusion of IAEA safeguards;

Article IX, para 6, providing for registration of the Treaty pursuant to Article 102 of the Charter of the UN.

(6) Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea-bed and the Ocean Floor and in the Subsoil Thereof: signed at Washington, London and Moscow on February 11, 1971; entered into force May 18, 1972

Preamble five, recalling the purposes and objectives of the UN Charter;

Article III, paras 4 and 5, providing for the referral of a dispute concerning fulfillment of obligations under the Treaty to the UN Security Council, and for verification of compliance with the Treaty through appropriate international procedures within the framework of the UN and in accordance with its Charter;

Article VIII, providing for notice of withdrawal to the UN Security Council;

Article X, para 6, providing for registration of the Treaty pursuant to Article 102 of the UN Charter.

(7) Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction; signed at Washington, London and Moscow on April 10, 1972; entered into force March 26, 1975.

Preambles four and six, recalling actions of the UN General Assembly and reaffirming the desire to contribute to the realization of the purposes and principles of the UN Charter;

Article V, providing for consultation and cooperation to be undertaken through appropriate international procedures within the framework of the UN and in accordance with its Charter;

Article VI, providing for lodging complaints concerning a breach of obligations to the UN Security Council and for investigations of complaints by the Security Council;

Article VII, providing for assistance to be provided, in accordance with the UN Charter, in the event the Security Council decides a party has been exposed to danger due to a violation of the Convention;

Article XIII, providing for notice of withdrawal to be given to the UN Security Council;

Article XIV, providing for registration of the Convention, pursuant to Article 102 of the UN Charter.

(8) Agreement between the United States of America and the USSR on the prevention of nuclear war: signed at Washington and entered into force on June 22, 1973.

Preamble four, recalling the obligations under the UN Charter regarding the maintenance of peace, refraining from the threat or use of force, and the avoidance of war;

Article V, affirming the right to keep the UN Security Council and Secretary-General informed of developments in consultations initiated pursuant to the agreement;

Article VI, referring to the right of individual or collective self-defence as envisaged by Article 51 of the UN Charter and to other Charter provisions including those relating to the maintenance or restoration of international peace and security.

(9) Treaty between the United States of America and the USSR on the limitation of underground nuclear weapon tests; signed at Moscow July 3, 1974 (not ratified).

Article V, para 3, providing for registration of the Treaty pursuant to Article 102 of the UN Charter.

(10) Treaty between the United States of America and the USSR on underground nuclear explosions for peaceful purposes: signed at Washington and Moscow on May 28, 1976 (not ratified).

Article VI, para 3, providing for the IAEA to be informed of the results of co-operation in the field of underground nuclear explosions for peaceful purposes;

Article IX, para 2, providing for the registration of the Treaty pursuant to Article 102 of the UN Charter.

(11) Convention on the prohibition of military or any other hostile use of environmental modification techniques: signed at Geneva on May 18, 1977; entered into force October 5, 1977.

Preambles four and eight, recalling the declaration of the UN Conference on the human environment adopted at Stockholm on 12 June 1976 and reaffirming the purposes and principles of the UN Charter;

Article V, providing for consultation and cooperation through appropriate international procedures within the UN framework and pursuant to its Charter; for the lodging of complaints relating to a breach of obligations with the UN Security Council which may initiate an investigation; and for assistance to be provided, pursuant to the UN Charter provisions, should the Security Council decide that a party has been harmed or is likely to be harmed as a result of violation of the Convention;

Article IX, paras two and six, providing for the deposit of instruments of ratification or accession with the UN Secretary-General and for the registration of the Convention in accordance with Article 102 of the UN Charter;

Article X, providing for the Convention to be deposited with the UN Secretary-General who is charged with sending certified copies thereof to the Government of the signatory and acceding States.